ASSESSMENT OF THE PRESENCE AND CAUSES OF SEDIMENT TOXICITY IN ARROYO COLORADO TIDAL, SEGMENT 2201

Prepared For

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IN COOPERATION WITH THE TEXAS NATURAL RESOURCES CONSERVATION COMMISSION AND THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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EXECUTIVE SUMMARY

Arroyo Colorado Tidal Segment 2201 (Toxicity in Sediment)

The Texas Commission on Environmental Quality (TCEQ) is responsible for administering provisions of the constitution and laws of the State of Texas to promote judicious use and the protection of the quality of waters in the State. A major aspect of this responsibility is the continuous monitoring and assessment of water quality to evaluate compliance with state water quality standards which are established within Texas Water Code, §26.023 and Title 30 Texas Administrative Code, §§307.1-307.10. Texas Surface Water Quality Standards 30 TAC 370.4(d) specify that surface waters will not be toxic to aquatic life. Pursuant to the federal Clean Water Act §303(d), states must establish Total Maximum Daily Loads (TMDLs) for pollutants contributing to violations of water quality standards. The purpose of this TMDL Study was to assess the presence and causes of ambient toxicity in seven Texas waterbodies listed on the Draft 2000 Federal Clean Water Act (CWA) §303(d) List in an effort to comply with Texas law.

In order to assess the waterbodies, this study provided goals as follows:

- Confirmation that toxicity is present more than 10% of the time, through the collection of up to date toxicity testing.
- The identification of the substance(s) or factors causing the toxicity where present.
- The identification of the sources of the toxicant(s).
- Confirmation, via chemical analysis, that water quality standards are being maintained.

This study was limited to the following seven waterbodies of concern:

1. Alligator Bayou (Segment 0702A) in Jefferson County (toxicity in water and sediment)
2. Bryan Municipal Lake (Segment 1209A) in Brazos County (toxicity in sediment)
3. Finfeather Lake (Segment 1209B) in Brazos County (toxicity in sediment)
4. Vince Bayou (Segment 1007A) in Harris County (toxicity in sediment)
5. Arroyo Colorado Tidal (Segment 2201) in Cameron County (toxicity in sediment)
6. Rio Grande (Segment 2304) in Kinney, Maverick, and Webb Counties (toxicity in water)
7. Rio Grande (Segment 2306) in Presidio County (toxicity in water).

The TCEQ selected Parsons to conduct a more thorough and intensive assessment of the existence of toxicity and identification of likely toxicants in the waterbodies. The Texas Surface Water Quality Standards specify that surface waters will not be toxic to aquatic life. Pursuant to the federal Clean Water Act §303(d), States must establish total maximum daily loads (TMDLs) for pollutants contributing to violations of surface water quality standards. Ambient toxicity testing complements routine chemical monitoring to identify waterbodies with aquatic life impairment. The waterbody assessments are each described in six different reports. Finfeather Lake and Bryan Municipal Lake are described in the same report due to their close proximity and likely cause.

The following table provides information regarding the ambient toxicity in Arroyo Colorado Tidal.

Segment & Waterbody Name	**Designated Use Impaired**	**Cause**	**Area Affected**	**Number of Samples Tested**	**Samples Exhibiting Toxicity**
2201 Arroyo Colorado Tidal	High Aquatic Life	Sediment Toxicity	Entire Segment	7	2

Ten sampling events were conducted on three stations within Arroyo Colorado Tidal, Segment 2201. The stations sampled were 13782, 13071, and 13072. The segment was placed on the 303(d) list for sediment toxicity due to a previous study (TWC 1989) and toxicity in sediment collected from Station 13782 in September and October 1993. Whereas the 1993 tests used an elutriate test protocol with sheepshead minnows as the surrogate species, the benthic macroinvertebrates *Neanthes* and *Leptocheirus* were used for whole sediment toxicity tests in this study.

All 10 sediment samples collected from the three stations over a 12-month period were not toxic to either *Neanthes* or *Leptocheirus*. In addition, the sediment chemistry results did not exceed any screening values. Therefore, it is requested that Segment 2201 be removed from future 303(d) lists for sediment toxicity based on no observed toxicity. The table below provides the detailed data used in this assessment.

Sediment Toxicity Test Results

Arroyo Colorado 2201		% Survival	% Survival
		Neanthes	***Leptocheirus***
April 23-24, 2001	Control	100	99
	13782	96	100
	13071	100	100
	13072-Dup	92	99
	13072	92	97
May 21-22, 2001	Control	96	90
	13782	100	85
	13071	92	96
	13072-Dup	96	88
	13072	100	87
June 11, 2001	Control	92	90
	13782	88	75
	13071	96	96
	13782-Dup	100	80
	13072	88	79
June 22, 2001	Contro9l	92	95
	13782	9	90
	13071	92	97
	13782-Dup	100	97
	13072	100	96
July 20, 2001	Control	100	99
	13782	100	99
	13071	96	99
	13072	100	96
	13072-Dup	88	98

Arroyo Colorado 2201		% Survival	% Survival
		Neanthes	***Leptocheirus***
August 10, 2001	Control	96	99
	13782	88	95
	13071	100	98
	13072	100	98
	13782-Dup	92	97
October 30, 2001	Control	100	98
	13782	100	99
	13071	100	100
	13072	100	99
December 18, 2001	Control	100	97
	13782	100	95
	13071	100	100
	13072	96	97
	13782-Dup	100	93
February 18, 2002	Control	100	99
	13782	100	96
	13071	100	93
	13072	100	92
	13782-Dup	96	100
April 8, 2002	Control	100	100
	13782	100	99
	13071	92	99
	13072	96	99
	13071-Dup	96	98

Leptocheirus plumulosus, Neanthes arenaceodentata

Bold – Denotes exceedance of recommended sediment toxicity criteria

Summary of Toxicity Test Results

Station	Significant Toxicity to *Neanthes*	Significant Toxicity to *Leptocheirus*
13782	0/10	0/10
13071	0/10	0/10
13072	0/10	0/10

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ACRONYMS & ABBREVIATIONS

ACT	Arroyo Colorado Tidal
CRP	Clean Rivers Program
CWA	Clean Water Act
DQO	Data quality objectives
FM	Farm to market
Km	Kilometer
LCS	Laboratory control standards
m	Meter
mg/L	Milligrams per liter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NOEC	No observed effect concentration
QAO	Quality assurance officer
QAPP	Quality assurance projected plan
QC	Quality control
SSI	Screening site inspection
SWQM	Surface water quality manual
TAC	Texas Administrative Code
the Arroyo	Arroyo Colorado Tidal, Segment 2201
TIE	Toxicity identification evaluation
TMDL	Total maximum daily load
TCEQ	Texas Commission on Environmental Quality
TNRCC	Texas Natural Resources Conservation Commission
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
WWTP	Wastewater treatment plant

SECTION 1
INTRODUCTION

The federal Clean Water Act (CWA), Section 305(b), requires states to produce a periodic inventory comparing water quality conditions to established water quality standards for surface waters. These surface waters and standards are specified in Texas Water Code, §26.023 and Title 30 Texas Administrative Code (TAC) §§307.1-307.10. Texas Surface Water Quality Standards 30 TAC 307.4(d) specify that surface waters will not be toxic to aquatic life. Pursuant to the federal CWA §303(d), states must publish and approve a list of state water bodies that do not meet the state water quality standards. In addition, the state must establish total maximum daily loads (TMDL) for pollutants contributing to violations of the water quality standards.

1.1 BACKGROUND INFORMATION

The Arroyo Colorado (also, the Arroyo) extends about 143.6 kilometers (km) from Farm to Market (FM) Road 2062, southwest of the City of Mission, Texas in Hidalgo County, eastward to the Laguna Madre, a marine estuary in Cameron County at the southern-most portion of Texas (Figure 1). The watershed lies in the neotropical Southern Coastal Plain physiographic region where surface geology is dominated by Quaternary alluvial deposits laid down by the Rio Grande. Lush, semitropical vegetation was formally supported in this region of Texas, but few natural vegetation and habitats still exist as the area is now extensively cultivated for agriculture.

The Arroyo primarily serves as a floodway for overflow waters from the Rio Grande, and secondarily as an inland waterway and a recreational resource for boating and fishing. The lower 42 km reach is tidally influenced and has been dredged to a depth of 5 meters (m) to accommodate barge traffic to the Port of Harlingen. The northern portion of the watershed is extensively urbanized, with population centers in the communities of Mission, McAllen, Pharr, Donna, Weslaco, Mercedes, Harlingen, and San Benito.

Segment 2201 (Arroyo Colorado Tidal (the Arroyo)) extends about 42.1 km from the lower boundary of Segment 2202 (Nueces-Rio Grande Coastal Basin) to its confluence with Laguna Madre. Designated uses for Segment 2201 are contact recreation and a high aquatic life use, with an accompanying 24-hour mean dissolved oxygen criterion of 4.0 mg/L.

Segment 2201 is identified on the State of Texas 1999 and draft 2000, 303(d) lists as partially supporting aquatic life due to periodic dissolved oxygen depression in the water and toxicity in ambient sediments. Monitoring conducted by Texas Commission on Environmental Quality (TCEQ) in Segment 2201 has also demonstrated elevated concentrations of nitrogen and phosphorus compounds.

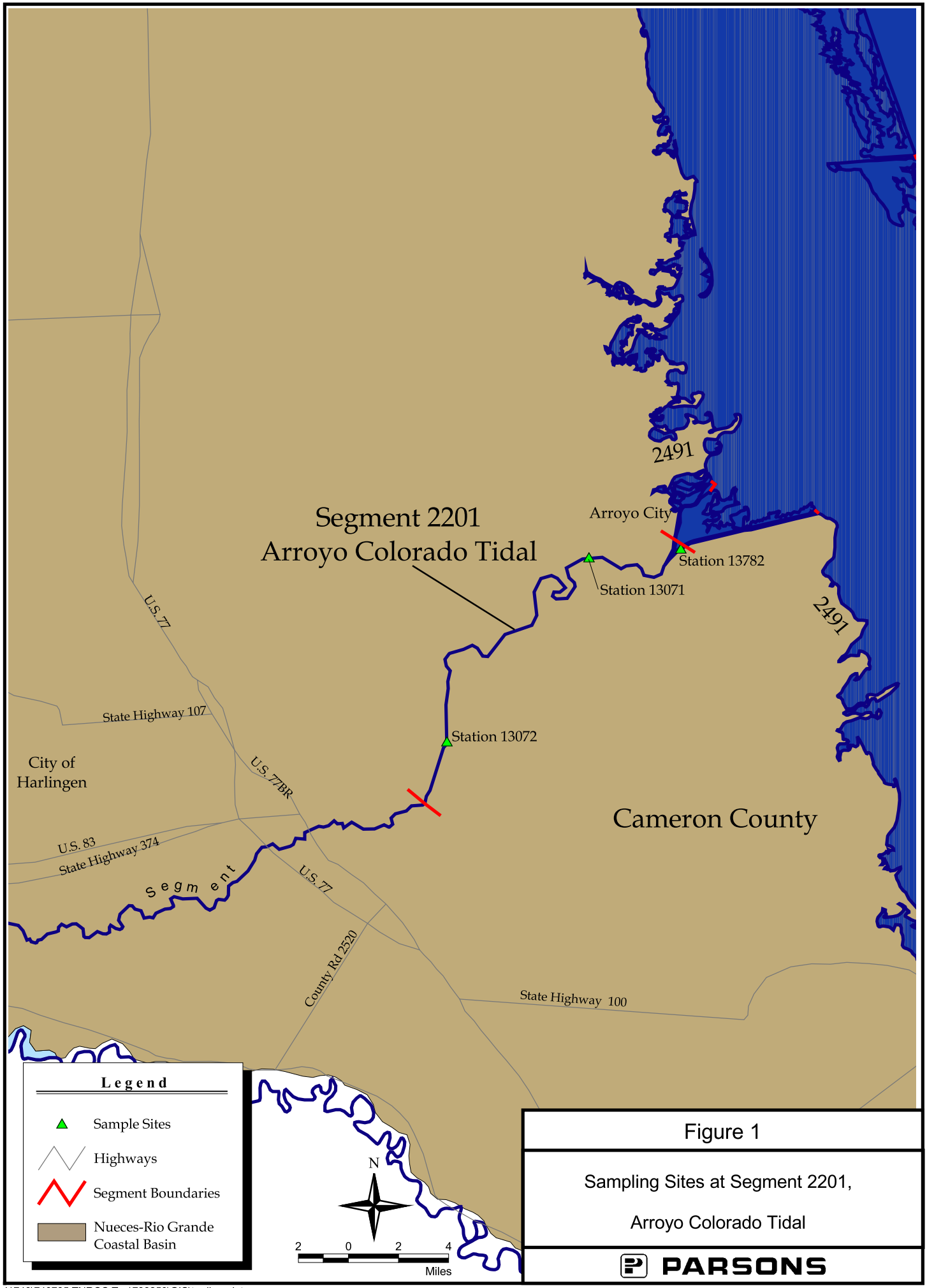

Figure 1

Sampling Sites at Segment 2201,

Arroyo Colorado Tidal

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The upper reach of the Arroyo above the tidal influence is designated as Segment 2202. This segment extends about 101.5 km from FM 2062 in Hidalgo County to 0.1 km below Cemetery Road near the Port of Harlingen in Cameron County. This portion of the Arroyo receives substantial amounts of urban runoff, discharge from four sanitary wastewater treatment plants (WWTP), and numerous irrigation return flows resulting from extensive agricultural activity. Designated uses for Segment 2202 include contact recreation and an intermediate aquatic life use, with a corresponding 24-hour mean dissolved oxygen criterion of 4.0 mg/L.

An intensive water quality survey of the Arroyo Colorado, which is divided into Segments 2201 (Tidal) and 2202 (above Tidal), was conducted under the auspices of Texas Water Commission (now TCEQ) in December 1987 (TWC 1989). The survey included assessments of toxic chemicals in water, sediment and tissues, ambient water toxicity testing, and biosurveys of benthic macroinvertebrates and nekton at six stations positioned from McAllen in the upper reaches of the Arroyo to the community of Arroyo City in the tidally affected lower reach of the Arroyo Colorado just upstream of its confluence with Laguna Madre. Results found an overall temporal reduction in toxic chemical contamination, based on comparison to data collected during a 1981 survey.

Water quality impairment resulting from the effects of toxic chemicals was found in Segment 2202, during the 1987 survey. The sources of toxic chemicals detected in tissues, sediment, and water were consistent mostly with agricultural runoff and irrigation return flows. Urban runoff may be contributing pollutants in a secondary role. Municipal wastewater discharges were found to be important sources of ammonia and chlorine.

In the 1987 survey, ambient water toxicity to *Ceriodaphnia dubia* (7-day exposure) was found in the Arroyo between the communities of Weslaco and Mercedes in Segment 2202, but was not found in water collected upstream or downstream of this site. A 7-day exposure test using the marine mysid, *Mysidopsis bahia* with endpoints of survival, growth, and reproduction, was conducted to assess ambient water toxicity in Arroyo Colorado water sampled at Arroyo City near the mouth of the Arroyo. Short-term chronic toxicity was not found at the No Observed Effect Concentration (NOEC) of 100 percent ambient water.

Macrobenthic community composition, structure, and density found in the lower reach of Segment 2201 near Arroyo City during the 1987 survey was similar to benthic communities known to exist in the Corpus Christi Inner Harbor. Benthic communities found in the Corpus Christi Inner Harbor are considered by the TCEQ to be consistent with an "intermediate" aquatic life use rating. At the time of the Arroyo Colorado survey, the use rating for aquatic life in the tidal segment of the Arroyo was designated as "high". Toxic chemicals found in low concentrations were not considered to be the cause of benthic community impairment at Station 13782 at Arroyo City. Factors contributing to low benthic community development were thought to relate to depressed dissolved oxygen in bottom waters and periodic maintenance dredging. It was conjectured that low dissolved oxygen was caused by a combination of high primary productivity and salinity stratification. The fine-particle substrate found in the Arroyo Colorado was also thought to contribute to depressed benthic

communities since low diversity positively correlates with bottom sediments of the type found in the surveyed portion of the Arroyo.

Sediments from the Arroyo Colorado were not tested for toxicity during the 1987 survey, but were evaluated for toxicity during TCEQ surveys conducted from 1993 to 1997. These more recent toxicity investigations found that ambient sediment in Segment 2201 was toxic in laboratory tests using the elutriate procedure and has lead to the 303d listing.

The purpose of this assessment is to verify the presence of toxicity in sediments within Segment 2201 found during the 1993 to 1997 monitoring period. If sediment toxicity is found, the cause(s) and source(s) of the sediment toxicity in the Arroyo will be determined.

1.2 DESCRIPTION OF THE SAMPLING STATIONS

Figure 1 shows the historical sampling sites used by the TCEQ, U.S. Environmental Protection Agency (USEPA) and U.S. Geological Survey (USGS) within the two segments of the Arroyo Colorado. Toxicity testing of water and sediments was conducted in Segment 2201 by the TCEQ at the following stations:

- 13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)
- 13072: Arroyo Colorado Tidal at FM 106 bridge at Rio Hondo
- 13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Mile 6.8

Toxicity was not found in water or sediments collected at Station 13071 during 1996 and 1997. Monitoring conducted by TCEQ from 1993 to 1997 found toxicity in ambient sediments at Station 13782 in September and October 1993. No water or sediments samples were collected by the TCEQ for Station 13072 prior to 1997.

This study investigates sediment toxicity and chemistry at Stations 13071. 13072, and 13782. The causes and sources of toxicity, if any, will be investigated for those sediments that demonstrate significant toxicity.

SECTION 2
PROBLEM DEFINITION

The TCEQ's 305(b) report for 1998 documented significant sediment toxicity at Station 13782 on Segment 2201 of the Arroyo Colorado. Additional concerns identified for Segment 2201 were low dissolved oxygen, and elevated concentrations of nitrogen and phosphorus compounds. The draft State of Texas 2000 CWA Section 303(d) list contains the following summary related to the tidal-influenced Segment 2201 of the Arroyo Colorado: *"In the upper 7.1 miles of the segment, dissolved oxygen concentrations are sometimes lower than the criterion established to assure optimum conditions for aquatic life (H/NS). Significant effects in ambient sediment toxicity tests sometimes occur, indicating that conditions are not optimum for aquatic life (M/NS)."*

Results of TCEQ ambient water and sediment toxicity monitoring, conducted from 1993 to 1997 on Arroyo Colorado Segment 2201, are summarized in Tables 2.1 and 2.2. Data presented in the tables show that no toxic effects were found at Station 13071 for five tests of water and one test of sediments based on testing from February 13, 1996 to July 15, 1997. None of the 11 water samples tested from September 29, 1993 to September 15, 1997 at Station 13782 exhibited toxicity; however, two of the six sediment samples tested during the same time period at Station 13782 demonstrated toxicity.

The historical sediment toxicity tests were performed by the USEPA laboratory in Houston, Texas, using the sediment elutriate test. This test requires mixing the sediment in laboratory water for a specified period of time then letting the sediment settle. The toxicity test is performed on the supernatant. It is believed this test maximizes the amount of potentially toxic dissolved compounds in the supernatant and may overstate the actual whole sediment toxicity to endemic benthic organisms. In addition, measured water column concentrations may also be overstated due to the elutriate procedure.

Tables 2.3 and 2.4 provide historical chemical analysis of sediment samples for two TCEQ sampling stations (13071 and 13782). Review of this data from 1995 to present shows approximately six sampling events for most chemical parameters; these two stations combined make up most of the detected compounds for metals. Metals detected in sediment from Station 13071 do not demonstrate exceedances of the lowest screening criteria (derived from *Equilibrium and Non-Equilibrium Partitioning-Based Sediment Quality Screening Indices*). A single sample collected at Station 13782 on October 19, 1995 contained concentrations of cadmium and nickel that exceed the screening indices. An occasional organic compound is detected throughout the data set. Appendix A contains the complete historical data information for these two stations over the past 5 years.

Table 2.1 Historical Ambient Water Toxicity

Arroyo Colorado Tidal		% Survival
		Cyprinodon Variegatus
July 15, 1997	Control	100
	13782	97
July 15, 1997	Control	90
	13071	100
	13782	100
July 17, 1996	Control	100
	13071	93
	13782	90
May 21, 1996	Control	100
	13071	97
	13782	93
April 3, 1996	Control	100
	13071	100
	13782	93
February 13, 1996	Control	97
	13071	100
October 19, 1995	Control	93
	13782	100
June 19, 1995	Control	90
	13782	97
November 28, 1994	Control	97
	13782	100
August 30, 1994	Control	100
	13782	97
March 9, 1994	Control	97
	13782	97
September 29, 1993	Control	90
	13782	83

Bold - denotes significant difference from the control

Table 2.2 Historical Sediment Toxicity

Arroyo Colorado Tidal		% Survival
		Cyprinodon Variegatus
July 17, 1996	Control	100
	13071	93
	13782	97
October 19, 1995	Control	93
	13782	97
August 30, 1994	Control	100
	13782	97
February 23, 1994	Control	97
	13782	87
October 26, 1993	Control	93
	13782	**40**
September 29, 1993	Control	90
	13782	**30**

Bold - denotes significant difference from the control

Table 2-3
Arroyo Colorado
Station 13071
Historical Sediment Chemistry Detections

PARAMETER	Historical Average	Historical Minimum	Historical Maximum	Lowest Screening Criteria*	UNITS
Aluminum in Bottom Deposits (mg/KG as AL Dry Wgt)	10800	10800	10800		mg/KG
Arsenic in Bottom Deposits (mg/KG as AS Dry Wgt)	2.4	2.4	2.4	7.24	mg/KG
Barium in Bottom Deposits (mg/KG as BA Dry wgt)	53.1	53.1	53.1		mg/KG
Bis(2-Ehtylhexyl) Phthalate Sed, Dry Wgt, µg/KG	1229	1229	1229		µg/KG
Cadmium, Total in Bottom Deposits (mg/Kg, Dry Wgt)	0.1	0.1	0.1	0.676	mg/KG
Chromium, Total in Bottom Deposits (mg/KG, Dry Wgt)	7.4	7.4	7.4	52.3	mg/KG
Copper in Bottom Deposits (mg/KG as CU Dry Wgt)	5.6	5.6	5.6	18.7	mg/KG
Lead in Bottom Deposits (mg/KG as PB Dry Wgt)	3.4	3.4	3.4	30.24	mg/KG
Manganese in Bottom Deposits (mg/KG as MN Dry Wgt)	295	295	295		mg/KG
Nickel, Total in Bottom Deposits (mg/KG, Dry Wgt)	6.7	6.7	6.7	15.9	mg/KG
Sediment Prctl. Size Class, 0.0039 Clay % Dry Wt	14	14	14		%
Sediment Prctl. Size, Sand .0625-2mm % Dry Wt	82	82	82		%
Sediment Prtcl. Size Class.0039.0625 Silt % Dry Wt	4	4	4		%
Selenium in Bottom Deposits (mg/KG as SE Dry Wt)	0.3	0.3	0.3		mg/KG
Solids in Sediment, Percent by Weight (Dry)	66.8	66.8	66.8		%
Zinc in Bottom Deposits (mg/KG as ZN Dry Wgt)	28.8	28.8	28.8	124.0	mg/KG

Notes:
* Criteria is from *Equilibrium and Non-Equilibrium Partitioning-Based Sediment Quality Screening Indices* tables. The value is the lowest value of Tier 1 indices based on an quatic chronic toxicity data set and Tier 2 indices based on draft EPA secondary chronic values (Appendix).

Table 2-4
Arroyo Colorado Station 13782
Historical Sediment Chemistry Detections

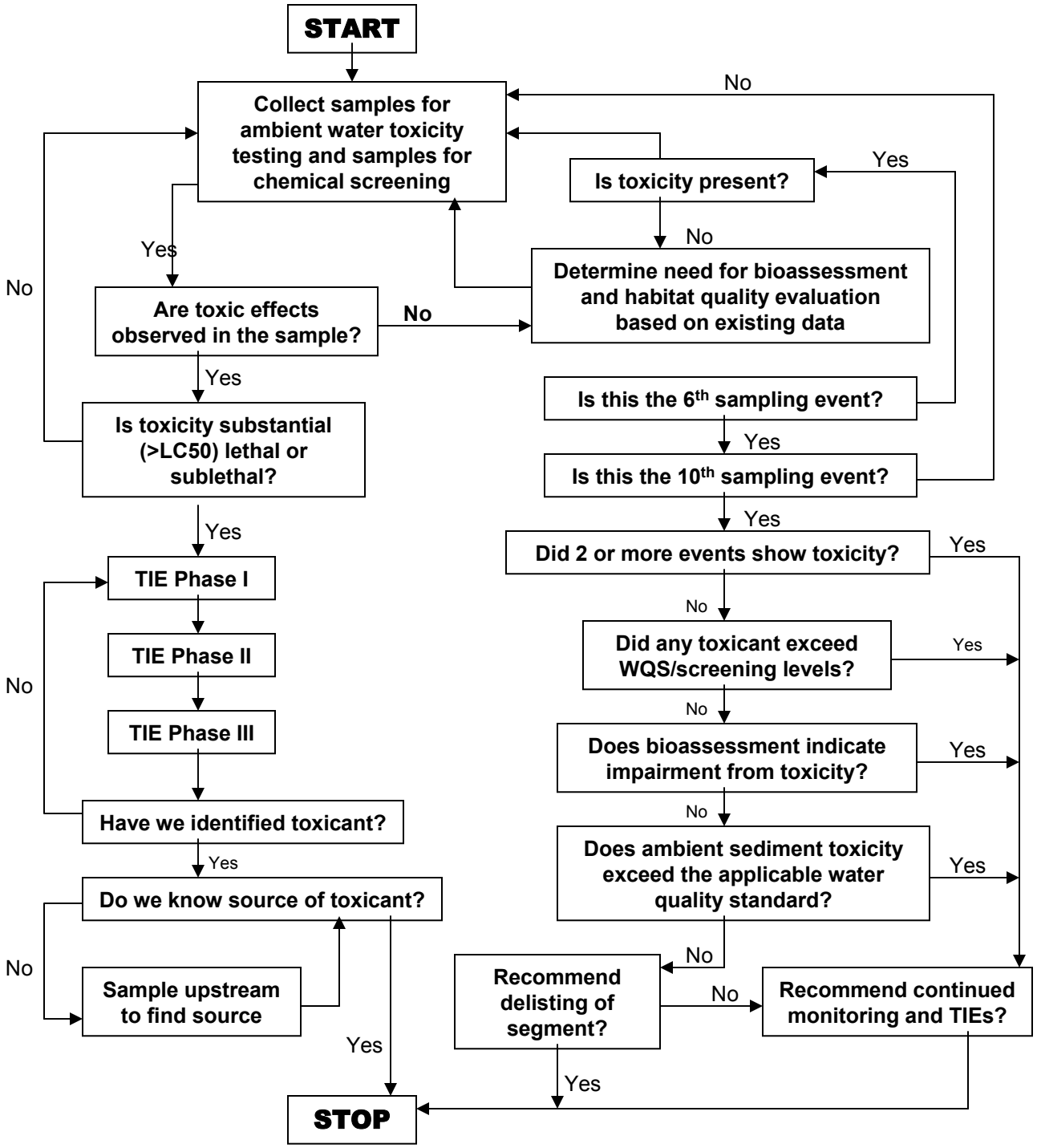
PARAMETER	Historical Average	Historical Minimum	Historical Maximum	Lowest Screening Criteria*	UNITS
Aluminum in Bottom Deposits (mg/KG as AL Dry Wgt)	13434	ND	39540		mg/KG
Barium in Bottom Deposits (mg/KG as BA Dry wgt)	72.7	47.1	114.7		mg/KG
Bromomethane in Sediment, (µg/KG)	13.00	ND	64.8		µg/KG
Cadmium, Total in Bottom Deposits (mg/Kg, Dry Wgt)	0.2	ND	**1.12**	0.676	mg/KG
Chromium, Total in Bottom Deposits (mg/KG, Dry Wgt)	7.6	ND	16.6	52.3	mg/KG
Copper in Bottom Deposits (mg/KG as CU Dry Wgt)	6.3	ND	16.7	18.7	mg/KG
Lead in Bottom Deposits (mg/KG as PB Dry Wgt)	2.9	ND	6.4	30.24	mg/KG
Manganese in Bottom Deposits (mg/KG as MN Dry Wgt)	3902	128	15013		mg/KG
Methylene Chloride Dry wgtbotµg/KG	7.7	ND	33.4		µg/KG
Nickel, Total in Bottom Deposits (mg/KG, Dry Wgt)	7.6	ND	**19.83**	15.9	mg/KG
Nitrogen Kjeldahl Total Bottom Dep. Dry Wt mg/KG	857	857	857		mg/KG
Phosphorus, Total, Bottom Deposit (mg/KG Dry Wgt)	517	517	517		mg/KG
Sediment Prctl. Size Class, 0.0039 Clay % Dry Wt	23	8	54		%
Sediment Prctl. Size, Sand .0625-2mm % Dry Wt	59	18	82		%
Sediment Prtcl. Size Class >2.0mm Gravel % Dry Wt	0.2	ND	1.0		%
Sediment Prtcl. Size Class.0039.0625 Silt % Dry Wt	18.3	9.3	32.0		%
Selenium in Bottom Deposits (mg/KG as SE Dry Wt)	1.0	ND	4.8		mg/KG
Silver in Bottom Deposits (mg/KG as AG Dry Wgt)	0.0	ND	0.01		mg/KG
Solids in Sediment, Percent by Weight (Dry)	51.9	27.2	69.9		%
Total Organic Carbon in Sediment Dry Wgt (mg/KG)	11488	1000	23000		mg/KG
Zinc in Bottom Deposits (mg/KG as ZN Dry Wgt)	10.5	ND	28.4	124.0	mg/KG

Notes:
* Criteria is from *Equilibrium and Non-Equilibrium Partitioning-Based Sediment Quality Screening Indices* tables. The value is the lowest value of Tier 1 indices based on an quatic chronic toxicity data set and Tier 2 indices based on draft EPA secondary chronic values (Appendix).
ND = Not Detectable

SECTION 3
ASSESSMENT STRATEGY AND OBJECTIVES

The objective of this assessment is one part of the larger objective of establishing fully supported designated uses for the Arroyo. The assessment seeks to determine the presence and causes of sediment toxicity. Figure 2 provides a conceptual toxicity strategy flow diagram for this study.

Figure 2 Conceptual Toxicity Strategy Flow Diagram



SECTION 4
ASSESSMENT METHODS

The following subsections describe the study design, sampling methods, sampling events, analytical methods, toxicity testing methods, quality control requirements, data management, and stream habitat characterization.

4.1 STUDY DESIGN

The general approach used in this assessment was a two-step investigative process. The first step involved determining if impairment of the designated uses continues. Delisting of the waterbody from the 303(d) list would be pursued if monitoring results demonstrated the waterbody was no longer impaired. Second, if toxicity was found to be present, a TIE would be performed to identify the toxicant or toxicants causing the impairment. Based on results of the TIE, attempts would be made to identify the source(s) of the toxicity. Appendix E contains the Data Quality Objectives (DQO) from the Quality Assurance Projected Plan (QAPP) along with methods numbers and reporting limits.

4.2 SAMPLING METHOD

Field measurements and sediment samples were collected from Stations 13782, 13072 and 13071 at Arroyo Colorado Segment 2201 during six sampling events from April 2001 through August 2001. Four additional sampling events were conducted on these sites in October and December 2001 and February and March 2002. During three of these sampling events, sediment for chemical analyses were collected at Station 13782. Table 4.1 identifies stations that were sampled, sampling frequencies, toxicity tests conducted, and chemical analysis performed.

Parsons' field staff followed the field sampling procedures for field measurements and sediment sample collection as described in the TCEQ *Surface Water Quality Monitoring Procedures Manual* (TCEQ 1999a) and the TCEQ *Receiving Water Assessment Procedures Manual* (TCEQ 1999b). Additional field sampling procedures outlined in this section reflect specific requirements for sampling under this TMDL Project.

The following subsections provide a summary of samples collected for each specific trip.

4.2.1 General Water Chemistry

Temperature, pH, dissolved oxygen, and specific conductivity were measured with an YSI Data Sonde when samples were collected from a sample location. These measurements were taken only after the water quality instrument was calibrated**.**

Table 4.1
Summary of Water and Sediment Sampling Events in Arroyo Colorado Tidal, Segment 2201

ANALYSES	April 23, 2001 Stations			May 21, 2001 Stations			June 11, 2001 Stations			June 22, 2001 Stations			July 20, 2001 Stations			August 10, 2001 Stations			October 30, 2001 Stations			December 18, 2001 Stations			February 18, 2002 Stations			April 8, 2002 Stations			Total
	13782	13071	13072	13782	13071	13072	13782	13071	13072	13782	13071	13072	13782	13071	13072	13782	13071	13072	13782	13071	13072	13782	13071	13072	13782	13071	13072	13782	13071	13072	
Field-measured parameters																															
Temperature, DO, pH, conductivity	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	27
SEDIMENT TOXICITY EVALUATION																															
Chronic Toxicity Bioassays																															
Neanthes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	30
Leptochirus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	30
Total Metals																															
As, Cd, Cr, Cu, Pb, Hg,Ni, Se, Ag, Zn							1									1									1						3
VOCs																															
Includes priority pollutant list							1									1									1						3
SVOCs																															
Includes priority pollutant list							1									1									1						3
PCBs							1									1									1						3
Pesticides/Herbicides including modern compounds							1									1									1						3
Polycyclic Aromatic Hydrocarbons							1									1									1						3
Total PAHs analysis (includes priority pollutant list)							1									1									1						3
Bioavailability Evaluation																															
TOC, AVS, SEM							1									1									1						3
Grain-Size Evaluation																															
Percent sand, silt, clay							1									1									1						3

4.3 SAMPLING EVENTS

The following are summaries of field notes taken by Parsons' field crews on the date specified.

4.3.1 Sampling on April 23/24, 2001

Parsons' field crew calibrated the YSI Data Sonde at 1325 hours. The field crew arrived at Station 13782 of Arroyo Colorado at 1600 hours on April 23, 2001. YSI Data Sonde measurements were taken and recorded. Sample 13782-1 was collected and the field crew departed for Station 13782. At 1645 the field crew arrived at Station 13071. YSI Data Sonde measurements were taken and recorded. Sediment sample 13071-1 was collected at 1649. Samples were put on ice overnight.

On April 24, 2001, the field crew arrived at Station 13072 of Arroyo Colorado at FM-106 at 0935 hours. YSI Data Sonde measurements were taken and recorded. GPS coordinates were recorded. Sediment sample 13072-1 and a duplicate of the sample were collected. The samples were iced and sent to analytical laboratories by FedEx along with the previous days' samples.

4.3.2 Sampling on May 21/22, 2001

Parsons' field crew calibrated the YSI Data Sonde at 1140. The field crew arrived at Station 13071 at 1335 hours on May 21, 2001. Water quality readings were measured using a YSI Data Sonde at 1343 hours. The YSI Data Sonde would not record measurements of dissolved oxygen concentration, only in dissolved oxygen percentage; however, temperature, conductivity, and pH measurements were collected at the site. Collected sediment sample 13071-2 (at marker 22), was collected at 1355 hours, and duplicate sediment sample 2201-DUPL at 1402 hours. The duplicate samples was taken for quality control purposes. The crew then left the site and proceeded to Station 13782.

The crew arrived at Station 13782 at 1539 hours. YSI Data Sonde readings were collected. Sediment sample 13782-2 was collected at 1550 hours. The crew then left the site and proceeded to the Sanchez boat launch and then to Station 13072.

Parsons' field crew arrived at Station 13072 at the Rio Hondo, 106 Bridge, at 0930 hours on May 22, 2001. YSI Data Sonde measurements were taken and recorded at 0955 hours. A sediment sample 13072-2 was then collected at 1000 hours. The crew then left the site and shipped the samples to the analytical laboratory by Federal Express (FedEx)at 1130 hours.

4.3.3 Sampling on June 11, 2001

Parsons' field crew calibrated the YSI Data Sonde at 0830 hours. Sediment samples were collected at Station 13782, sample ID 13872-3, at 1030 hours on June 11, 2001, and a duplicate sediment sample, 2201-DUPL, was collected at 1115 hours for both toxicity and chemistry. YSI Data Sonde readings were collected for the site at 1128 hours. The crew

departed Station 13782 for Station 13071. The crew arrived at Station 13071 at 1205 hours and collected sediment sample 13071-3 at 1220 hours. The YSI Data Sonde measurements were collected at 1245 hours; then the crew departed the site and proceeded to Station 13072.

Parsons' field crew arrived at Station 13072 at 1410 hours. YSI Data Sonde measurements were collected and recorded at 1420 hours. Sediment sample 13072-3 was collected at 1435 hours. The crew then left the site and shipped the samples to the analytical laboratory at 1100 hours by FedEx on June 12, 2001.

4.3.4 Sampling on June 22, 2001

Parsons' field crew arrived at Arroyo Colorado at Station 13782 on June 22, 2001 at 1018 hours. YSI Data Sonde measurements were taken and recorded at 1023. A sediment sample (13782-4) was collected at 1030 hours, a duplicate sample (2201-DUPL) was collected at 1040 hours. At 1130 hours the field crew arrived at Station 13071. YSI Data Sonde measurements were taken and recorded at 1136 hours. Sediment sample 13071-4 was collected at 1142 hours. The field crew departed this site and arrived at Station 13072 at 1235 hours. YSI Data Sonde measurements were taken and recorded at 1245 hours. The sediment sample 13072-4 was collected at 1259 hours. The samples were iced and shipped by Fed Ex to the analytical laboratories at 1430 hours.

4.3.5 Sampling on July 20, 2001

Parsons' field crew arrived at Arroyo Colorado at Station 13072 on July 20, 2001 at 0930 hours. Hydrolab Data Sonde measurements were taken and recorded at 0935 hours. Sediment sample 13072-5 was collected at 0935 hours and a duplicate sample (2201-DUPL) was collected at 0945 hours. At 1105 hours the field crew arrived at Station 13782. Hydrolab Data Sonde measurements were taken and recorded at 1110 hours, then sediment sample 13782-5 was collected. Sediment samples were collected for chemical analysis as well as toxicity from this site as well. A number of samples collected for chemical analysis destined for DHL were lost in shipping. Station 13782 was resampled on August 10th for the parameters analyzed by DHL only.

The field crew departed this site and arrived at Station 13071 at 1215 hours. Hydrolab Data Sonde measurements were taken and recorded at 1225 hours. Sediment sample 13071-5 was collected at 1235 hours. The samples were iced and shipped by Fed Ex to the analytical laboratories at 1400 hours.

4.3.6 Sampling on August 10, 2001

Parsons' field crew arrived at Arroyo Colorado at Station 13782 on August 10, 2001 at 1020 hours. YSI Data Sonde measurements were taken and recorded at 1030 hours. Sediment sample 13782-6 and a duplicate sample 2201-DUPL, were collected at 1100 hours. Sediment was also collected for chemical analysis to make up for the missed analyses from the July event. At 1210 hours the field crew arrived at Station 13071. YSI Data Sonde measurements were taken and recorded at 1215 hours. Sediment sample 13071-6 was

collected at 1230 hours. The field crew departed this site and arrived at Station 13072 at 1425 hours. YSI Data Sonde measurements were taken and recorded at 1430 hours. Sediment sample 13072-6 was collected at 1440 hours. The samples were iced and shipped by FedEx to the analytical laboratories at 1530 hours from Harlingen.

4.3.7 Sampling on October 30, 2001

Parsons' field crew arrived at Arroyo Colorado at Station 13072 on October 30, 2001 at 1310 hours. YSI Data Sonde measurements were taken and recorded at 1320 hours. Sediment sample 13072-A was collected at 1315 hours. At 1510 hours the field crew arrived at Station 13071. YSI Data Sonde measurements were taken and recorded at 1520 hours. Sediment sample 13071-A and a duplicate of this sample, 2201-DUPL, were collected at 1535 hours and 1550 hours respectively. The field crew departed this site and arrived at Station 13782 at 1650 hours. YSI Data Sonde measurements were taken and recorded at 1700 hours. Sediment sample 13782-A was collected at 1710 hours. The samples were iced and shipped by Fed Ex to the analytical laboratories at 1850 hours from Harlingen.

4.3.8 Sampling on December 18, 2001

Parsons' field crew arrived at Arroyo Colorado at Station 13072 on December 18, 2001 at 0930 hours. YSI Data Sonde measurements were not taken or recorded. Sediment sample 13072-b and a duplicate of this sample were collected at 1100 hours. At 1200 hours the field crew arrived at Station 13071. YSI Data Sonde measurements were not taken or recorded. Sediment sample 13071-b was collected at 1220 hours. The field crew departed this site and arrived at Station 13072 at 1330 hours. YSI Data Sonde measurements were not taken or recorded. Sediment sample 13782-b was collected at 1350 hours. The samples were iced and sent by Fed Ex to the analytical laboratories at 1645 hours from Harlingen. At 1930 hours the YSI unit was examined and batteries replaced; it then worked correctly.

4.3.9 Sampling on February 18, 2002

Parsons' field crew arrived at Arroyo Colorado at Station 13782 on February 18, 2002 at 0955 hours. YSI Data Sonde measurements were taken and recorded at 1010 hours. Sediment sample 13072-c and duplicate sample 2201-DUPL were collected at 1025 hours and 1040 hours for toxicity and chemical analysis, respectively. One of these chemical analysis sample containers was broken during shipping, but an adequate quantity of sample from the other container was available to complete all analyses.

At 1215 hours the field crew arrived at Station 13071. YSI Data Sonde measurements were taken and recorded at 1225 hours. Sediment sample 13071-c was collected at 1235 hours. The field crew departed this site and arrived at Station 13072 at 1440 hours. YSI Data Sonde measurements were taken and recorded at 1455 hours. Sediment sample 13072-c was collected at 1510 hours. The samples were iced and sent by Fed Ex to the analytical laboratories at 1655 hours from Harlingen.

4.3.10 Sampling on April 8, 2002

Parsons' field crew arrived at Arroyo Colorado at Station 13782 on April 8, 2002 at 1140 hours. YSI Data Sonde measurements were taken and recorded at 1150 hours. Sediment toxicity sample 13782-D was collected at 1200 hours. At 1325 hours the field crew arrived at Station 13071. YSI Data Sonde measurements were taken and recorded at 1335 hours. Sediment sample 13071-D was collected at 1345 hours and duplicate sample 2201-DUPL was collected at 1415 hours. The field crew departed this site and arrived at Station 13072 at 1540 hours. YSI Data Sonde measurements were taken and recorded at 1645 hours. Sediment sample 13072-D was collected at 1655 hours. The samples were iced and sent by Fed Ex to the analytical laboratories at 1840 hours from Harlingen.

4.4 ANALYTICAL METHODS

Appendix E lists a combination of the analytical methods used and other available methods for potential toxicant identification. The analytical methods are included in the approved QAPP. The analytical methods listed in the table are USEPA-approved methods as cited in TCEQ TMDL guidance document, Clean Rivers Program (CRP) or Surface Water Quality Manual (SWQM) Program Guidance and in 40 Code of Federal Regulations, Section 136, Part B. Exceptions to this include methods and sample matrices for which no regulated methods exist, or where USEPA has not approved any method with adequate sensitivity for TMDL data requirements.

4.5 TOXICITY TESTING METHODS

The toxicity of sediments was assessed by the following methods using the marine amphipod *Leptocheirus plumulosus* and the marine polychaete worm *Neanthes arenaceodentata*:

- Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods (USEPA/600/R-94/025).
- Evaluation of Dredged Material proposed for Discharge in Waters of the U.S. – Testing Manual (USEPA 823-B-98-004)

For toxicity testing, marine amphipods and polychaetes were exposed for 10 days to sediment collected from three stations positioned within Segment 2201 of the Arroyo Colorado Tidal. Mortality at the end of the 10-day exposure period was statistically compared to mortality found in control organisms exposed to clean sediments supplied by the testing laboratory.

Whereas USEPA-approved methods are developed to identify causes of toxicity in effluents and ambient water, approved methods are not yet available for performing toxicity identification evaluations (TIE) on sediments. In recent years, considerable progress has been made by USEPA and other research entities to develop TIE methods for sediments. The sediment TIE methods used in this investigation were developed through the coordinated efforts of scientists at USEPA's laboratory in Duluth, Minnesota, scientists at North Texas

State University, TRAC Laboratories, and Parsons using the most recent scientific advances in the subject area.

4.6 QUALITY CONTROL REQUIREMENTS

Refer to the Assessment of the Presence and Causes of Ambient Toxicity Quality Assurance Project Plan (QAPP), Revision 4, FY 2002-03

4.6.1 Sampling Quality Control Requirements and Acceptability Criteria

The minimum field quality control (QC) requirements followed by Parsons were outlined in the TCEQ *Surface Water Quality Monitoring Procedures Manual* and in Section B5 of the project QAPP. Sampling QC involved use of field duplicates, matrix spikes and matrix spike duplicates.

4.6.2 Laboratory Measurement Quality Control Requirements and Acceptability Criteria

These requirements and criteria were applicable to all laboratories used for analysis of various required parameters. Detailed laboratory QC requirements were contained within each individual method and laboratory quality assurance manuals. As described in Section B5 of the project QAPP, the minimum requirements followed by analytical laboratories included: 1) laboratory duplicates; 2) laboratory control standards (LCS); 3) matrix spikes and matrix spike duplicates; 4) method blanks; and 5) additional QC samples such as surrogates, internal standards, continuing calibration samples, and interference check samples. Laboratory QC sample results were reported with the data report (see Section C2 of the project QAPP).

4.6.3 Failures in Quality Control Requirements

As described in Section B5 of the project QAPP, sampling QC excursions were evaluated by the Parsons Project Manager, in consultation with the Parsons Quality Assurance Officer (QAO). Differences in field duplicate sample results were used to assess the entire sampling process, including environmental variability. The arbitrary rejection of results based on pre-determined limits was not practical, therefore, the professional judgment of the Parsons Project Manager and QAO was relied upon when evaluating results. Rejecting sample results based on wide variability was a possibility. Corrective action included identification of the cause of the failure where possible. Response actions typically included re-analysis of questionable samples. In some cases, a site was re-sampled to achieve project goals, as in the case of resampling that occurred in May and July 2001 due to lost and broken sample containers. The disposition of such failures and conveyance to the TCEQ are discussed in Section B4 of the project QAPP under Failures or Deviations in Analytical Methods Requirements and Corrective Actions.

Refer to Appendix D for the summarization of QA/QC findings, data acceptability and qualifiers to deviations.

4.7 DATA MANAGEMENT

Data management protocols are addressed in the Data Management Plan which is Appendix E of the project QAPP.

4.8 STREAM HABITAT CHARACTERIZATION

Stream habitat characterization utilizing TCEQ procedures was performed during the April sampling event by completing copies of the TCEQ's receiving water assessment forms (Stream Physical Characteristics Worksheets) for each location. The detailed forms are located in Appendix G.

SECTION 5
AMBIENT SEDIMENT ANALYSIS

5.1 AMBIENT SEDIMENT TOXICITY RESULTS

Toxicity tests were performed on sediments collected in April, May, June, July, August, October, and December of 2001 from Stations 13782, 13071, and 13072. Sediment samples were collected twice during June 2001. Additional sediment samples were collected in February and April 2002 for a total of 10 events. Sediment toxicity was evaluated by a 10-day sediment exposure test with the marine amphipod, *Leptocheirus plumulosus* and the marine polychaete worm, *Neanthes arenaceodentata* using methods specified in Section 4.4 of the report. Criteria for determining whether significant sediment toxicity occurred to *Neanthes* and *Leptocheirus* are specified in the Technical Memorandum in Appendix F of this report. Each of the following conditions must each be met for a sediment sample to be considered toxic:

1. A statistically significant reduction in survival, at alpha equal to 0.05.
2. Mortality in the sample exceeds 20 percent of the original number of organisms.
3. Mortality in the sample must be more than the maximum control mortality allowed by USEPA methods.

Similar conditions to these have been utilized by TCEQ previously in the permit requirements for conditions that trigger a TIE/TRE in TPDES permits. These conditions assure that a sample is ecologically significant and some quantifiable amount of increased survival may be observed in conducting a TIE.

Using the criteria stated above, none of the sediments from the three Arroyo stations sampled during the 10 events exhibited toxicity. Table 5.1 present results of toxicity testing of sediments collected from Segment 2201 of the Arroyo Colorado.

5.2 OTHER STUDIES

TCEQ in cooperation with USEPA Region 6, produced a Screening Site Inspection (SSI) Report for Segments 2201 and 2202 of the Arroyo Colorado in July 2001. Three known sources of pesticide contamination adjacent to the Arroyo have been remediated in the past, one of which is still undergoing post-cleanup monitoring. Several potential contaminant sources still exist on the Arroyo segments. The SSI report is used to determine if the segment qualifies as a federal or state superfund site.

Table 5.1
Arroyo Colorado 2201
10 Day Marine Sediment Exposure Results

Arroyo Colorado 2201		% Survival	% Survival
		Neanthes	Leptocheirus
April 23-24, 2001	Control	100	99
	13782	96	100
	13071	100	100
	13072-Dup	92	99
	13072	92	97
May 21-22, 2001	Control	96	90
	13782	100	85
	13071	92	96
	13072-Dup	96	88
	13072	100	87
June 11, 2001	Control	92	90
	13782	88	75
	13071	96	96
	13782-Dup	100	80
	13072	88	79
June 22, 2001	Control	92	95
	13782	92	90
	13071	92	97
	13782-Dup	100	97
	13072	100	96
July 20, 2001	Control	100	99
	13782	100	99
	13071	96	99
	13072	100	96
	13072-Dup	88	98
August 10, 2001	Control	96	99
	13782	88	95
	13071	100	98
	13072	100	98
	13782 Dup	92	97
October 30, 2001	Control	100	98
	13782	100	99
	13071	100	100
	13072	100	99
	13071 Dup	96	100
December 18, 2001	Control	100	97
	13782	100	95
	13071	100	100
	13072	96	97
	13782 Dup	100	93

Table 5.1
Arroyo Colorado 2201
10 Day Marine Sediment Exposure Results

February 18, 2002	Control	100	99
	13782	100	96
	13071	100	93
	13072	100	92
	13782 Dup	96	100
April 8, 2002	Control	100	100
	13782	100	99
	13071	92	99
	13072	96	99
	13071-Dup	96	98

Leptocheirus plumulosus, Neanthes arenaceodentata
Bold - denotes significant difference from the control
* - sample collected in approximately the same location

The SSI report documents a sediment sampling event performed by the TCEQ, at 21 sites in Segments 2201 and 2202 on March 13, 14 and 15, 2001. Some samples from the SSI were collected at sites near Stations 13071, 13072, and 13782 in the toxicity TMDL study. The SSI sampling sites that were approximately coincident with the toxicity sites were SE-17, SE-32 and SE-13, respectively. Eight sites sampled by TCEQ showed contaminant concentrations in sediment elevated enough to be considered releases to surface water. Site SE-13 was one of the sites found to have sediment contaminants, 4,4'-DDD (6.5 µg/Kg) and 4,4'-DDT (79 µg/Kg), at levels elevated enough to be considered a release. Other contaminants found at significant levels in the other seven contaminated sites were; 4,4'-DDE, selenium and cyanide. Seven of the eight contaminated sites were located upstream of site SE-13 (13782). In October 2002, the TCEQ received a No Further Remedial Action Plan (NFRAP) under Superfund letter from USEPA. Nevertheless, the TCEQ may remediate contaminated sediment under the state's Superfund program. A TDH fish advisory is still in effect on Segments 2201 and 2202 for Smallmouth Buffalo fish for elevated PCB concentrations.

TCEQ has already performed a TMDL, completed in June 2001, for legacy pollutants (currently banned pollutants) on the Arroyo Colorado Above Tidal, Donna Reservoir, and Canal System, and no further regulation will be enacted on these contaminants. Segments 2202 and 2202A are immediately upstream of Segment 2201, which is the subject of this report. Legacy pollutants were not detected in the chemical analysis of Station 13782.

The sediment chemical analysis results from the USEPA's Screening Site Inspection Report, Volume I, July 2001 (Arroyo Colorado, Cameron/Willacy Counties, Texas-TX0 000 605 364, Table 9) are listed below in Table 5.2.

5.3 FIELD MEASUREMENTS

All field measurements were within expected ranges during these sampling events. Table 5.3 presents the results from these events.

5.4 CHEMICAL ANALYTICAL RESULTS

Table 5.4 presents only detected concentrations of parameters found in samples taken from Station 13782 in the June, August, and February sampling events. Note: The June sampling results indicate that only ions and metals were detectable in the sediment, and no organic chemicals were detected. August sampling results again show only ions and some metals detectable at low levels. February 2002 results were similar to previous events that show only detection of ions and some low level metals. No results exceeded screening levels.

Table 5.2
Chemical Analysis of Sediment
Screening Site Inspection Report, USEPA, July 2001

Sample Location/CLP ID	Hazardous Substance	Concentration
SE-11/F05M1	4,4' -DDD	ND
	4,4' -DDE	ND
	4,4' -DDT	ND
MFHQ03	Selenium	ND
	Cyanide	2.1Jv mg/Kg
SE-13/F05M3	4,4' -DDD	6.5 μg/Kg
	4,4' -DDE	3.6 LJ μg/Kg
	4,4' -DDT	79 μg/Kg
MFHQ05	Selenium	ND
	Cyanide	0.26LJv mg/Kg
SE-22/F05N2	4,4' -DDD	ND
	4,4' -DDE	1.5 LJ μg/Kg
	4,4' -DDT	6.7 μg/Kg
MFJN91	Selenium	ND
	Cyanide	0.39 LR mg/Kg
SE-24/F05N4	4,4' -DDD	ND
	4,4' -DDE	3.2 LJ μg/Kg
	4,4' -DDT	5.3 μg/Kg
MFJP99	Selenium	2.1 J mg/Kg
	Cyanide	0.19 UR mg/Kg
SE-28	4,4' -DDD	ND
SE-28/F05N8	4,4' -DDE	44 μg/Kg
	4,4' -DDT	ND
MFJQ05	Selenium	ND
	Cyanide	1.2 R mg/Kg
Se-29	4,4' -DDD	ND
F05N9	4,4' -DDE	30 μg/Kg
	4,4' -DDT	ND
MFHT73	Selenium	ND
	Cyanide	0.67 LR mg/Kg
SE-30/F05P0	4,4' -DDD	0.87 LJ μg/Kg
	4,4' -DDE	17 μg/Kg
	4,4' -DDT	3.9LJB μg/Kg
MFHT74	Selenium	ND
	Cyanide	1.6 R mg/Kg
SE-31/F05P1	4,4' -DDD	0.66 LJ μg/Kg
	4,4' -DDE	25 μg/Kg
	4,4' -DDT	4.1 LJ μg/Kg
MFGR43	Selenium	2.2 UCJ mg/Kg
	Cyanide	1.2 R mg/Kg

[ ] = Sample quantitation limit (SQL).
ND = Not detected at the SQL.
NA = Not applicable.
J, J^, or Jv = Sample results are estimated and biased high/low due to a quality control problems.
UC = Reported concentration should be used as a raised detection limit because of apparent blank contamination.
R = Result is unusable.
Shaded Results = the result met observed release criteria for that hazardous substance.
L = Reported concentration is below SQL.

Table 5.3
Field Measurements

Water Quality Measurements
Arroyo Colorado Tidal
Segment 2201
Station 13071

Date M/D/Y	Temp °C	DO Conc mg/L	pH	Cond uS/cm	TRC mg/l
521/01	30.06	No Reading	8.55	17980	No Reading
6/11/2001	33.61	12.21	8.34	18743	No Reading
6/22/2001	30.57	12.35	8.75	6435	No Reading
7/20/2001	32.8	7.68	8.78	24522	No Reading
8/10/2001	33.1	6.35	8.24	18900	No Reading
10/30/2001	27.03	10.53	8.26	2447	No Reading
12/18/2001	No Reading	No Reading	No Reading	No Reading	No Reading
2/18/2002	18.45	EM	8.15	32290	No Reading
4/8/2002	23.55	7.2	No Reading	5980	No Reading

Water Quality Measurements
Arroyo Colorado Tidal
Segment 2201
Station 13072

Date M/D/Y	Temp °C	DO Conc mg/L	pH	Cond uS/cm	TRC mg/l
5/22/2001	27.05	No Reading	8.1	7970	No Reading
6/11/2001	33.34	8.05	7.75	4562	No Reading
6/22/2001	31.91	7.89	7.98	2019	No Reading
7/20/2001	29.75	2.33	7.52	17664	No Reading
8/10/2001	33.81	9.73	7.82	4700	No Reading
10/30/2001	24.74	16.25	8.38	3542	No Reading
12/18/2001	No Reading	No Reading	No Reading	No Reading	No Reading
2/18/2002	19.95	EM	8.49	6850	No Reading
4/8/2002	23.41	4.36	No Reading	31630	No Reading

Water Quality Measurements
Arroyo Colorado Tidal
Segment 2201
Station 13782

Date M/D/Y	Temp °C	DO Conc mg/L	pH	Cond uS/cm	TRC mg/l
5/21/2001	29.77	No Reading	8.7	19680	No Reading
6/11/2001	32.21	11.2	8.35	14400	No Reading
6/22/2001	29.93	6.12	8.43	9050	No Reading
7/20/2001	31.46	5.02	8.4	29668	No Reading
8/10/2001	30.82	6.02	8.63	23600	No Reading
10/30/2001	24.8	10.61	8.47	2993	No Reading
12/18/2001	No Reading	No Reading	No Reading	No Reading	No Reading
2/18/2002	17.25	EM	7.77	36980	No Reading
4/8/2002	23.16	3.5	No Reading	34390	No Reading

°C - degrees Celcius
mg/L - milligrams per liter
mS/cm - milli Siemens per centimeter
ft - feet
pH is in standard units
Cond - Conductivity
DO Conc - Dissolved oxygen concentration
TRC - Total residual chlorine
% Sat. - only unit reading available for DO due to instrument limitations at time of data collection
EM = probable equipment malfunction

Table 5.4
Chemical Analysis Detections

		Station ID 13782				
	PARAMETER	6/11/01 RESULT	8/10/01 RESULT	2/18/02 RESULT	Lowest Screening Value*	UNITS
Ions	Chloride	2140	2660	4990		mg/Kg-dry wt
	Sulfate	485	512	848		mg/Kg-dry wt
Metals	Aluminum	7880	4670	6940		mg/Kg-dry wt
	Arsenic	2.07	2.21	1.92	7.24	mg/Kg-dry wt
	Barium	120	56.2	63.1		mg/Kg-dry wt
	Calcium	24900	16600	21400		mg/Kg-dry wt
	Chromium	6.68	5.47	6.47	52.3	mg/Kg-dry wt
	Copper	3.61	3.28	3.65	18.7	mg/Kg-dry wt
	Iron	7750	6140	7610		mg/Kg-dry wt
	Lead	4.82	4.09	4.38	30.2	mg/Kg-dry wt
	Magnesium	2710	2130	2580		mg/Kg-dry wt
	Nickel	5.14	3.98	4.94	15.9	mg/Kg-dry wt
	Potassium	2390	1760	2310		mg/Kg-dry wt
	Sodium	1670	2060	3030		mg/Kg-dry wt
	Zinc	20.3	16	19.9	124	mg/Kg-dry wt
	PARAMETER	6/11/01 RESULT	7/20/01 RESULT	2/18/02 RESULT	Lowest Screening Value*	UNITS
SEM	Cadmium	0.03 J	ND	ND		µmol/dry g
	Copper	0.89	1.2	0.12		µmol/dry g
	Lead	2.21	2.1	0.026		µmol/dry g
	Mercury	0.0003 J	ND	ND		µmol/dry g
	Nickel	0.87	1.5	0.037		µmol/dry g
	Silver	0.522	ND	NA		µmol/dry g
	Zinc	15.5 U	1.3	0.46		µmol/dry g
	Total Organic Carbon (TOC)	1800	3986	1900		mg/Kg
	Acid Volatile Sulfide (AVS)	138	ND	0.24		µmol/dry g
Grain Size	Sand	84.05	86.6	44.0		%
	Silt	8.55	7.70	40.50		%
	Clay	7.4	5.70	15.10		%

Notes:

* Criteria is from *Equilibrium and Non-Equilibrium Partitioning-Based Sediment Quality Screening Indices* tables. The value is the lowest value from the Indicies as stated in the Appendix.

J- result is estimated

ND- result was Not Detected

mg/kg-dry = milligrams per kilogram dry weight

ug/kg-dry = microgram per kilogram dry weight

umol/dry g = microgram per mole per dry gram

% = percent

SECTION 6
TOXICITY IDENTIFICATION EVALUATION

No TIE was performed since no sediment samples exhibited toxicity.

SECTION 7
SOURCE ANALYSIS AND IDENTIFICATION

No source identification has been conducted since no sites were identified to have ambient sediment toxicity.

SECTION 8
SUMMARY AND CONCLUSIONS

Ten sampling events were conducted on three stations at Arroyo Colorado Tidal, Segment 2201. The stations sampled were 13782, 13071, and 13072. The segment was placed on the 303(d) List for sediment toxicity due to a previous study (TWC 1989) and toxicity in sediment collected from Station 13782 in September and October 1993. The 1993 tests used the elutriate test protocol with sheepshead minnows as the surrogate species.

All 10 samples collected from the three stations over a recent 12-month period were not toxic to either of the surrogate test species. Therefore, it is requested that Segment 2201 be removed from future 303(d) Lists for sediment toxicity based on no observed toxicity. In addition, the sediment chemistry results did not exceed any screening criteria values.

Continued routine sediment sampling is recommended. According to the TCEQ, further action may be warranted in the chemically contaminated areas, predominantly upstream of Station 13072, identified in the Screening Site Inspection Report.

SECTION 9
REFERENCES

TRAC Laboratories, 2001. 10 Day Sediment Toxicity Screens Exposing *Leptocherius plumulosus and Neanthes arenaceodentata* to Sediments from Segments 1007A and 2201, August 2001, Pensacola, Florida.

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APPENDIX A
HISTORICAL DATA

Appendix A
Arroyo Colorad Tidal Station 13071 Sediment Table

Station	Long Description	Data	Total
13071	1,1,1-TRICHLOROETHANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,1,2,2-TETRACHLOROETHANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,1,2-TRICHLOROETHANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,1-DICHLOROETHANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,1-DICHLOROETHYLENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,2,4,5-TETRACHLOROBENZENE SEDIMENT DRY WT (UG/K	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,2,4-TRICHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,2,5,6-DIBENZANTHRACENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,2-DICHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,2-DICHLOROETHANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,2-DICHLOROPROPANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,3-DICHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	1,4-DICHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2,4,5-TRICHLOROPHENOL IN SEDIMENT,DRY WT (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2,4,6-TRICHLOROPHENOL DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2,4-DICHLOROPHENOL DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2,4-DIMETHYLPHENOL DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2,4-DINITROPHENOL DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2,4-DINITROTOLUENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2,6-DINITROTOLUENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1

Appendix A
Arroyo Colorad Tidal Station 13071 Sediment Table

13071	2-CHLORONAPHTHALENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2-CHLOROPHENOL DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	2-NITROPHENOL DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	3,3'-DICHLOROBENZIDINE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	4-BROMOPHENYL PHENYL ETHER DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	4-CHLOROPHENYL PHENYL ETHER DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	4-NITROPHENOL DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ACENAPHTHENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ACENAPHTYLENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ACRYLONITRILE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ALUMINUM IN BOTTOM DEPOSITS (MG/KG AS AL DRY WGT	Min of Value	10800
		Max of Value	10800
		Average of Value	10800.0
		Count of Value	1
	ANTHRACENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ARSENIC IN BOTTOM DEPOSITS (MG/KG AS AS DRY WGT)	Min of Value	2.38
		Max of Value	2.38
		Average of Value	2.4
		Count of Value	1
	BARIUM IN BOTTOM DEPOSITS (MG/KG AS BA DRY WGT)	Min of Value	53.1
		Max of Value	53.1
		Average of Value	53.1
		Count of Value	1
	B-BHC-BETA DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BENZENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BENZO(B)FLUORANTHENE,SEDIMENTS, DRY WGT,UG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BENZO(K)FLOURANTHENE DRY WTBOT UG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BENZO-A-PYRENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BIS (2-CHLOROETHOXY) METHANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BIS (2-CHLOROETHYL) ETHER DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BIS (2-CHLOROISOPROPYL) ETHER DRY WGTBOTUG/KG	Min of Value	0

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Arroyo Colorad Tidal Station 13071 Sediment Table

13071	BIS (2-CHLOROISOPROPYL) ETHER DRY WGTBOTUG/KG	Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BIS(2-ETHYLHEXYL) PHTHALATE SED, DRY WGT,UG/KG	Min of Value	1229.4
		Max of Value	1229.4
		Average of Value	1229.4
		Count of Value	1
	BROMODICHLOROMETHANE DRY WEIGHT BOTTOM (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BROMOFORM DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	BROMOMETHANE IN SEDIMENT, (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	CADMIUM,TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT)	Min of Value	0.062
		Max of Value	0.062
		Average of Value	0.1
		Count of Value	1
	CARBON TETRACHLORIDE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	CHLORDANE(TECH MIX&METABS) SED,DRY WGT,UG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	CHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	CHLOROETHANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	CHLOROFORM DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	CHLOROMETHANE SEDIMENT DRY WEIGHT (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	CHROMIUM,TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT	Min of Value	7.38
		Max of Value	7.38
		Average of Value	7.4
		Count of Value	1
	CHRYSENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	CIS-1,3-DICHLOROPROPENE SEDIMENT DRY WGT UG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	COPPER IN BOTTOM DEPOSITS (MG/KG AS CU DRY WGT)	Min of Value	5.64
		Max of Value	5.64
		Average of Value	5.6
		Count of Value	1
	CRESOL IN SEDIMENT, DRY WEIGHT, (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	DELTA BENZENE HEXACHLORIDE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	DEMETON IN SEDIMENT (SYSTOX) DRY WEIGHT (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	DIBROMOCHLOROMETHANE DRY WEIGHT BOTTOM (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	DIETHYL PHTHALATE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	DIMETHYL PHTHALATE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0

Appendix A
Arroyo Colorad Tidal Station 13071 Sediment Table

13071	DIMETHYL PHTHALATE DRY WGTBOTUG/KG	Average of Value	0.0
		Count of Value	1
	DI-N-BUTYL PHTHALATE, SEDIMENTS,DRY WGT,UG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	DI-N-OCTYL PHTHALATE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	DNOC (4,6-DINITRO-ORTHO-CRESOL) DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	DURSBAN BOTTOM DEPOSITS DRY WGT (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ENDOSULFAN SULFATE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ETHYLBENZENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	FLUORANTHENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	FLUORENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	GAMMA BHC (LINDANE), SEDIMENT, DRY WT (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	HEXACHLOROBUTADIENE BOT. DEPOS. (UG/KG DRY WGT)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	HEXACHLOROCYCLOPENTADIENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	HEXACHLOROETHANE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	INDENO (1,2,3-CD) PYRENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ISOPHORONE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	LEAD IN BOTTOM DEPOSITS (MG/KG AS PB DRY WGT)	Min of Value	3.38
		Max of Value	3.38
		Average of Value	3.4
		Count of Value	1
	MANGANESE IN BOTTOM DEPOSITS (MG/KG AS MN DRY WG	Min of Value	295
		Max of Value	295
		Average of Value	295.0
		Count of Value	1
	MERCURY,TOT. IN BOT. DEPOS. (MG/KG) AS HG DRY WG	Min of Value	0.012
		Max of Value	0.012
		Average of Value	0.0
		Count of Value	1
	METHYLENE CHLORIDE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	NAPHTHALENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	N-BUTYL BENZYL PHTHALATE, SEDIMENTS,DRY WGT,UG/K	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	NICKEL, TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT)	Min of Value	6.66
		Max of Value	6.66
		Average of Value	6.7

Appendix A
Arroyo Colorad Tidal Station 13071 Sediment Table

13071	NICKEL, TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT)	Count of Value	1
	NITROBENZENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	N-NITROSODIMETHYLAMINE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	N-NITROSO-DI-N-BUTYLAMINE, DRY WT,SEDIMENT (UG/K	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	N-NITROSODI-N-PROPYLAMINE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	N-NITROSODIPHENYLAMINE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	PENTACHLOROBENZENE IN SEDIMENT UG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	PHENANTHRENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	PHENOL(C6H5OH)-SINGLE COMPOUND DRY WGTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	PYRENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	PYRIDINE SEDIMENT DRY WEIGHT (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	SEDIMENT PRCTL.SIZE CLASS 0.0039 CLAY %DRY WT	Min of Value	14
		Max of Value	14
		Average of Value	14.0
		Count of Value	1
	SEDIMENT PRCTL.SIZE CLASS,SAND .0625-2MM %DRY W	Min of Value	82
		Max of Value	82
		Average of Value	82.0
		Count of Value	1
	SEDIMENT PRTCL.SIZE CLASS >2.0MM GRAVEL %DRY WT	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	SEDIMENT PRTL.SIZE CLASS.0039-.0625 SILT %DRY W	Min of Value	4
		Max of Value	4
		Average of Value	4.0
		Count of Value	1
	SELENIUM IN BOTTOM DEPOSITS (MG/KG AS SE DRY WT)	Min of Value	0.33
		Max of Value	0.33
		Average of Value	0.3
		Count of Value	1
	SEVIN IN SEDIMENT DRY WEIGHT (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	SILVER IN BOTTOM DEPOSITS (MG/KG AS AG DRY WGT)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	SOLIDS IN SEDIMENT, PERCENT BY WEIGHT (DRY)	Min of Value	66.76
		Max of Value	66.76
		Average of Value	66.8
		Count of Value	1
	TETRACHLOROETHYLENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	TOLUENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	TOTAL ORGANIC CARBON IN SEDIMENT DRY WGT (MG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1

Appendix A
Arroyo Colorad Tidal Station 13071 Sediment Table

13071	TRANS-1,2-DICHLOROETHENE, IN SED. DRY WT. UG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	TRANS-1,3-DICHLOROPROPENE SEDIMENT DRY WGT UG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	TRICHLOROETHYLENE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	VINYL CHLORIDE DRY WGTBOTUG/KG	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	XYLENE SEDIMENT, DRY WGT (UG/KG)	Min of Value	0
		Max of Value	0
		Average of Value	0.0
		Count of Value	1
	ZINC IN BOTTOM DEPOSITS (MG/KG AS ZN DRY WGT)	Min of Value	28.8
		Max of Value	28.8
		Average of Value	28.8
		Count of Value	1
13071 Min of Value			0
13071 Max of Value			10800
13071 Average of Value			113.5
13071 Count of Value			111
Total Min of Value			0
Total Max of Value			10800
Total Average of Value			113.5
Total Count of Value			111

Appendix A
Arroyo Colorad Tidal Station 13782 Sediment Table

Station	Long Description	Data	Total
13782	1,1,1-TRICHLOROETHANE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	1,1,1-TRICHLOROETHANE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	1,1,2,2-TETRACHLOROETHANE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	1,1,2,2-TETRACHLOROETHANE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	1,1,2-TRICHLOROETHANE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	1,1,2-TRICHLOROETHANE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	1,1-DICHLOROETHANE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	1,1-DICHLOROETHANE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	1,1-DICHLOROETHYLENE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	1,1-DICHLOROETHYLENE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	1,2,4,5-TETRACHLOROBENZENE SEDIMENT DRY WT (UG/K	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	1,2,4,5-TETRACHLOROBENZENE WHOLE WATER (UG/L)	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	1,2,4-TRICHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	9
		Max of Value	2799
		Average of Value	1569.38
		Count of Value	5
	1,2,4-TRICHLOROBENZENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	1,2,5,6-DIBENZANTHRACENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	1,2,5,6-DIBENZANTHRACENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	1,2-DIBROMOETHANE SEDIMENT, DRY WEIGHT (UG/KG)	Min of Value	9
		Max of Value	530
		Average of Value	269.5
		Count of Value	2
	1,2-DIBROMOETHANE WHOLE WATER (UG/L)	Min of Value	2
		Max of Value	2
		Average of Value	2
		Count of Value	1
	1,2-DICHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	9
		Max of Value	2799
		Average of Value	1569.38
		Count of Value	5
	1,2-DICHLOROBENZENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	1,2-DICHLOROETHANE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530

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13782	1,2-DICHLOROETHANE DRY WGTBOTUG/KG	Average of Value	114.02
		Count of Value	5
	1,2-DICHLOROETHANE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	1,2-DICHLOROPROPANE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	1,2-DICHLOROPROPANE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	1,2-DIPHENYLHYDRAZINE DRY WGTBOTUG/KG	Min of Value	2000
		Max of Value	2247.2
		Average of Value	2123.6
		Count of Value	2
	1,2-DIPHENYLHYDRAZINE TOTWUG/L	Min of Value	5.3
		Max of Value	5.3
		Average of Value	5.3
		Count of Value	1
	1,3-DICHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	9
		Max of Value	2799
		Average of Value	1569.38
		Count of Value	5
	1,3-DICHLOROBENZENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	1,4-DICHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	9
		Max of Value	2799
		Average of Value	1569.38
		Count of Value	5
	1,4-DICHLOROBENZENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	2,4,5-T IN BOTTOM DEPOSITS (UG/KG DRY SOLIDS)	Min of Value	6.2
		Max of Value	21
		Average of Value	12.54
		Count of Value	5
	2,4,5-T IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.5
		Max of Value	5
		Average of Value	2
		Count of Value	4
	2,4,5-TRICHLOROPHENOL IN SEDIMENT,DRY WT (UG/KG)	Min of Value	791.7
		Max of Value	4100
		Average of Value	2267.58
		Count of Value	5
	2,4,5-TRICHLOROPHENOL WHOLE WATER (UG/L)	Min of Value	5
		Max of Value	11
		Average of Value	6.7
		Count of Value	4
	2,4,6-TRICHLOROPHENOL DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	4100
		Average of Value	2267.58
		Count of Value	5
	2,4,6-TRICHLOROPHENOL TOTWUG/L	Min of Value	5
		Max of Value	11
		Average of Value	6.7
		Count of Value	4
	2,4-D IN BOTTOM DEPOSITS (UG/KG DRY SOLIDS)	Min of Value	6.2
		Max of Value	100
		Average of Value	28.34
		Count of Value	5
	2,4-D IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.5
		Max of Value	20
		Average of Value	5.725
		Count of Value	4
	2,4-DICHLOROPHENOL DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	4100
		Average of Value	2267.58
		Count of Value	5
	2,4-DICHLOROPHENOL, TOTWUG/L	Min of Value	5
		Max of Value	11
		Average of Value	6.7
		Count of Value	4
	2,4-DIMETHYLPHENOL DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	4100
		Average of Value	2267.58
		Count of Value	5
	2,4-DIMETHYLPHENOL, TOTWUG/L	Min of Value	5
		Max of Value	11
		Average of Value	6.7

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13782	2,4-DIMETHYLPHENOL, TOTWUG/L	Count of Value	4
	2,4-DINITROPHENOL DRY WGTBOTUG/KG	Min of Value	1583.3
		Max of Value	5598
		Average of Value	3735.14
		Count of Value	5
	2,4-DINITROPHENOL, TOTWUG/L	Min of Value	10
		Max of Value	11
		Average of Value	10.65
		Count of Value	4
	2,4-DINITROTOLUENE DRY WGTBOTUG/KG	Min of Value	14
		Max of Value	2799
		Average of Value	1570.38
		Count of Value	5
	2,4-DINITROTOLUENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	2,6-DINITROTOLUENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	2,6-DINITROTOLUENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	2-CHLOROETHYL VINYL ETHER DRY WGTBOTUG/KG	Min of Value	50
		Max of Value	5300
		Average of Value	2675
		Count of Value	2
	2-CHLOROETHYL VINYL ETHER TOTWUG/L	Min of Value	20
		Max of Value	20
		Average of Value	20
		Count of Value	1
	2-CHLORONAPHTHALENE DRY WGTBOTUG/KG	Min of Value	1583.3
		Max of Value	5598
		Average of Value	3418.925
		Count of Value	4
	2-CHLORONAPHTHALENE TOTWUG/L	Min of Value	5.3
		Max of Value	11
		Average of Value	9.225
		Count of Value	4
	2-CHLOROPHENOL DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	2-CHLOROPHENOL IN WATER (UG/L)	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	2-NITROPHENOL DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	4100
		Average of Value	2267.58
		Count of Value	5
	2-NITROPHENOL TOTWUG/L	Min of Value	5
		Max of Value	11
		Average of Value	6.7
		Count of Value	4
	3,3'-DICHLOROBENZIDINE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1663.566667
		Count of Value	3
	3,3'-DICHLOROBENZIDINE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.266666667
		Count of Value	3
	4-BROMOPHENYL PHENYL ETHER DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	4-BROMOPHENYL PHENYL ETHER TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	4-CHLOROPHENYL PHENYL ETHER DRY WGTBOTUG/KG	Min of Value	14
		Max of Value	2799
		Average of Value	1570.38
		Count of Value	5
	4-CHLOROPHENYL PHENYL ETHER TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	4-NITROPHENOL DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	8200
		Average of Value	3087.58
		Count of Value	5

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13782	4-NITROPHENOL TOTWUG/L	Min of Value	5
		Max of Value	21
		Average of Value	9.2
		Count of Value	4
	ACENAPHTHENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	ACENAPHTHENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	ACENAPHTYLENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	ACENAPHTYLENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	ACID VOLATILE SULFIDE (AVS), (MMOL/KG)	Min of Value	2.5
		Max of Value	2.5
		Average of Value	2.5
		Count of Value	1
	ACRYLONITRILE DRY WGTBOTUG/KG	Min of Value	50
		Max of Value	2600
		Average of Value	600.04
		Count of Value	5
	ACRYLONITRILE TOTWUG/L	Min of Value	5
		Max of Value	50
		Average of Value	28.75
		Count of Value	4
	ALDRIN IN BOTTOM DEPOS. (UG/KG DRY SOLIDS)	Min of Value	1.7
		Max of Value	28.6
		Average of Value	13.754
		Count of Value	5
	ALDRIN IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.05
		Max of Value	0.2
		Average of Value	0.1125
		Count of Value	4
	ALKALINITY, TOTAL (MG/L AS CACO3)	Min of Value	146
		Max of Value	226
		Average of Value	191.8076923
		Count of Value	26
	ALPHA BENZENE HEXACHLORIDE IN WHOLE WATER SAMPLE	Min of Value	0.03
		Max of Value	0.1
		Average of Value	0.07
		Count of Value	4
	ALUMINUM IN BOTTOM DEPOSITS (MG/KG AS AL DRY WGT	Min of Value	0.01
		Max of Value	39539.85
		Average of Value	13433.972
		Count of Value	5
	ALUMINUM, DISSOLVED (UG/L AS AL)	Min of Value	33
		Max of Value	41
		Average of Value	36
		Count of Value	3
	ANTHRACENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	ANTHRACENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	ARSENIC IN BOTTOM DEPOSITS (MG/KG AS AS DRY WGT)	Min of Value	0.05
		Max of Value	3.9
		Average of Value	2.198
		Count of Value	5
	ARSENIC, DISSOLVED (UG/L AS AS)	Min of Value	9.05
		Max of Value	33
		Average of Value	17.35
		Count of Value	3
	BARIUM IN BOTTOM DEPOSITS (MG/KG AS BA DRY WGT)	Min of Value	47.1
		Max of Value	114.65
		Average of Value	72.6875
		Count of Value	4
	B-BHC-BETA DRY WGTBOTUG/KG	Min of Value	1.7
		Max of Value	28.6
		Average of Value	13.754
		Count of Value	5
	BENZENE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	BENZENE IN WTR SMPLE GC-MS, HEXADECONE EXTR.UG/L	Min of Value	2

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13782	BENZENE IN WTR SMPLE GC-MS, HEXADECONE EXTR.UG/L	Max of Value	5
		Average of Value	4.25
		Count of Value	4
	BENZIDINE IN BOTTOM DEPOS (UG/KG DRY SOLIDS)	Min of Value	791.7
		Max of Value	2799
		Average of Value	1809.475
		Count of Value	4
	BENZIDINE IN WHOLE WATER SAMPLE (UG/L)	Min of Value	5
		Max of Value	5.5
		Average of Value	5.266666667
		Count of Value	3
	BENZO(A)ANTHRACENE1,2-BENZANTHRACENDRYWTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	BENZO(A)ANTHRACENE1,2-BENZANTHRACENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	BENZO(B)FLUORANTHENE, WHOLE WATER, UG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	BENZO(B)FLUORANTHENE,SEDIMENTS, DRY WGT,UG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	BENZO(GHI)PERYLENE1,12-BENZOPERYLENDRYWTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	BENZO(GHI)PERYLENE1,12-BENZOPERYLENE TOTWUG/L	Min of Value	5
		Max of Value	15.9
		Average of Value	7.925
		Count of Value	4
	BENZO(K)FLOURANTHENE DRY WTBOT UG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	BENZO(K)FLOURANTHENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	BENZO-A-PYRENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	BENZO-A-PYRENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	BETA BENZENE HEXACHLORIDE IN WHOLE WATER SAMP	Min of Value	0.03
		Max of Value	0.1
		Average of Value	0.07
		Count of Value	4
	BHC-ALPHA ISOMER, BOTTOM DEPOS (UG/KG DRY SOL)	Min of Value	1.7
		Max of Value	28.6
		Average of Value	13.754
		Count of Value	5
	BIS (2-CHLOROETHOXY) METHANE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	BIS (2-CHLOROETHOXY) METHANE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	BIS (2-CHLOROETHYL) ETHER DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	BIS (2-CHLOROETHYL) ETHER TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	BIS (2-CHLOROISOPROPYL) ETHER DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	BIS (2-CHLOROISOPROPYL) ETHER TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	BIS(2-ETHYLHEXYL) PHTHALATE SED, DRY WGT,UG/KG	Min of Value	791.7
		Max of Value	2799

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13782	BIS(2-ETHYLHEXYL) PHTHALATE SED, DRY WGT,UG/KG	Average of Value	1847.58
		Count of Value	5
	BIS(2-ETHYLHEXYL) PHTHALATE,WHOLE WATER,UG/L	Min of Value	5
		Max of Value	48.4
		Average of Value	16.05
		Count of Value	4
	BROMODICHLOROMETHANE DRY WEIGHT BOTTOM (UG/KG)	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	BROMODICHLOROMETHANE,WHOLE WATER,UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	BROMOFORM DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	BROMOFORM, WHOLE WATER, UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	BROMOMETHANE IN SEDIMENT, (UG/KG)	Min of Value	5
		Max of Value	1300
		Average of Value	278.12
		Count of Value	5
	BROMOMETHANE WATER, WHOLE, RECOVERABLE, UG/L	Min of Value	5
		Max of Value	5
		Average of Value	5
		Count of Value	4
	CADMIUM, DISSOLVED (UG/L AS CD)	Min of Value	4
		Max of Value	5
		Average of Value	4.666666667
		Count of Value	3
	CADMIUM,TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT)	Min of Value	0.01
		Max of Value	1.12
		Average of Value	0.2484
		Count of Value	5
	CALCIUM, DISSOLVED (MG/L AS CA)	Min of Value	213
		Max of Value	258
		Average of Value	239
		Count of Value	3
	CARBON TETRACHLORIDE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	CARBON TETRACHLORIDE,WHOLE WATER,UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	CARBON, TOTAL ORGANIC (MG/L AS C)	Min of Value	1
		Max of Value	11
		Average of Value	3.716
		Count of Value	25
	CHLORDANE (TECH MIX & METABS),WHOLE WATER,UG/L	Min of Value	0.2
		Max of Value	0.4
		Average of Value	0.35
		Count of Value	4
	CHLORDANE(TECH MIX&METABS) SED,DRY WGT,UG/KG	Min of Value	13.3
		Max of Value	1144
		Average of Value	254.996
		Count of Value	5
	CHLORIDE (MG/L AS CL)	Min of Value	3350
		Max of Value	13900
		Average of Value	7337.076923
		Count of Value	26
	CHLOROBENZENE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	CHLOROBENZENE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	CHLOROETHANE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	1300
		Average of Value	268.02
		Count of Value	5
	CHLOROETHANE TOTWUG/L	Min of Value	5
		Max of Value	5
		Average of Value	5
		Count of Value	4
	CHLOROFORM DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02

13782	CHLOROFORM DRY WGTBOTUG/KG	Count of Value	5
	CHLOROFORM, WHOLE WATER, UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	CHLOROMETHANE SEDIMENT DRY WEIGHT (UG/KG)	Min of Value	5
		Max of Value	1300
		Average of Value	268.02
		Count of Value	5
	CHLOROMETHANE, WATER, WHOLE, RECOVERABLE, UG/L	Min of Value	5
		Max of Value	5
		Average of Value	5
		Count of Value	4
	CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH	Min of Value	1
		Max of Value	53.3
		Average of Value	12.99423077
		Count of Value	26
	CHROMIUM, DISSOLVED (UG/L AS CR)	Min of Value	3
		Max of Value	5
		Average of Value	3.666666667
		Count of Value	3
	CHROMIUM,TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT	Min of Value	0.01
		Max of Value	16.57
		Average of Value	7.592
		Count of Value	5
	CHRYSENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	CHRYSENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	CIS-1,3-DICHLOROPROPENE SEDIMENT DRY WGT UG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	CIS-1,3-DICHLOROPROPENE TOTAL IN WATER UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	COPPER IN BOTTOM DEPOSITS (MG/KG AS CU DRY WGT)	Min of Value	0.01
		Max of Value	16.66
		Average of Value	6.286
		Count of Value	5
	COPPER, DISSOLVED (UG/L AS CU)	Min of Value	4
		Max of Value	12
		Average of Value	8
		Count of Value	3
	CRESOL IN SEDIMENT, DRY WEIGHT, (UG/KG)	Min of Value	2375
		Max of Value	8397
		Average of Value	4902.72
		Count of Value	5
	CRESOL (UG/L)	Min of Value	11
		Max of Value	16.5
		Average of Value	14.6
		Count of Value	4
	CYANIDE (MG/L AS CN)	Min of Value	0.02
		Max of Value	0.02
		Average of Value	0.02
		Count of Value	1
	DAYS SINCE PRECIPITATION EVENT (DAYS)	Min of Value	0
		Max of Value	30
		Average of Value	7.8125
		Count of Value	16
	DDD IN BOTTOM DEPOS. (UG/KGDRY SOLIDS)	Min of Value	15.1
		Max of Value	57.3
		Average of Value	30.24
		Count of Value	5
	DDD IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.1
		Max of Value	0.3
		Average of Value	0.2
		Count of Value	4
	DDE IN BOTTOM DEPOS. (UG/KG DRY SOLIDS)	Min of Value	8.3
		Max of Value	57.3
		Average of Value	28.5
		Count of Value	5
	DDE IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.1
		Max of Value	0.2
		Average of Value	0.175
		Count of Value	4
	DDT IN BOTTOM DEPOS. (UG/KG DRY SOLIDS)	Min of Value	15.1
		Max of Value	57.3
		Average of Value	30.24
		Count of Value	5

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13782	DDT IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.1
		Max of Value	0.3
		Average of Value	0.2
		Count of Value	4
	DELTA BENZENE HEXACHLORIDE DRY WGTBOTUG/KG	Min of Value	1.7
		Max of Value	28.6
		Average of Value	13.754
		Count of Value	5
	DELTA BENZENE HEXACHLORIDE TOTWUG/L	Min of Value	0.03
		Max of Value	0.1
		Average of Value	0.07
		Count of Value	4
	DEMETON IN SEDIMENT (SYSTOX) DRY WEIGHT (UG/KG)	Min of Value	50
		Max of Value	250
		Average of Value	123.5
		Count of Value	4
	DEMETON IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.5
		Max of Value	0.5
		Average of Value	0.5
		Count of Value	3
	DEPTH OF BOTTOM OF WATER BODY AT SAMPLE SITE MET	Min of Value	4.2
		Max of Value	4.8
		Average of Value	4.566666667
		Count of Value	3
	DIAZINON IN BOT. DEPOS. (UG/KG DRY SOLIDS)	Min of Value	8.3
		Max of Value	250
		Average of Value	100.46
		Count of Value	5
	DIAZINON IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.3
		Max of Value	0.5
		Average of Value	0.45
		Count of Value	4
	DIBROMOCHLOROMETHANE DRY WEIGHT BOTTOM (UG/KG)	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	DIBROMOCHLOROMETHANE, WHOLE WATER, UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	DICOFOL (KELTHANE) SEDIMENT,DRY WT (UG/KG)	Min of Value	83
		Max of Value	83
		Average of Value	83
		Count of Value	1
	DICOFOL IN WHOLE WATER SAMPLE (UG/L)	Min of Value	2
		Max of Value	2
		Average of Value	2
		Count of Value	1
	DIELDRIN IN BOTTOM DEPOS. (UG/KG DRY SOLIDS)	Min of Value	5
		Max of Value	28.6
		Average of Value	14.414
		Count of Value	5
	DIELDRIN IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.05
		Max of Value	0.1
		Average of Value	0.0875
		Count of Value	4
	DIETHYL PHTHALATE DRY WGTBOTUG/KG	Min of Value	14
		Max of Value	2799
		Average of Value	1570.38
		Count of Value	5
	DIETHYL PHTHALATE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	DIMEHTYL PHTHALATE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	DIMETHYL PHTHALATE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	DI-N-BUTYL PHTHALATE, SEDIMENTS,DRY WGT,UG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	DI-N-BUTYL PHTHALATE,WHOLE WATER,UG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	DI-N-OCTYL PHTHALATE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	DI-N-OCTYL PHTHALATE TOTWUG/L	Min of Value	5

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Arroyo Colorad Tidal Station 13782 Sediment Table

13782	DI-N-OCTYL PHTHALATE TOTWUG/L	Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	DISSOLVED OXYGEN, 24-HOUR AVG. (MG/L) MIN. 4 MEA	Min of Value	5.9
		Max of Value	9.23
		Average of Value	7.613333333
		Count of Value	3
	DISSOLVED OXYGEN, 24-HOUR MAX. (MG/L) MIN. 4 MEA	Min of Value	8.4
		Max of Value	12.8
		Average of Value	10.86666667
		Count of Value	3
	DISSOLVED OXYGEN, 24-HOUR MIN. (MG/L) MIN. 4 MEA	Min of Value	3.7
		Max of Value	7.4
		Average of Value	5.113333333
		Count of Value	3
	DISSOLVED OXYGEN, NUMBER MEASUREMENTS DURING 24-	Min of Value	24
		Max of Value	24
		Average of Value	24
		Count of Value	3
	DNOC (4,6-DINITRO-ORTHO-CRESOL) DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	8200
		Average of Value	3087.58
		Count of Value	5
	DNOC (4,6-DINITRO-ORTHO-CRESOL) TOTWUG/L	Min of Value	5
		Max of Value	21
		Average of Value	9.2
		Count of Value	4
	DURSBAN BOTTOM DEPOSITS DRY WGT (UG/KG)	Min of Value	8.3
		Max of Value	250
		Average of Value	100.46
		Count of Value	5
	DURSBAN(CHLOROPYRIFOS)WHOLE WATER SAMPLE (UG/L)	Min of Value	0.5
		Max of Value	0.6
		Average of Value	0.525
		Count of Value	4
	ENDOSULFAN IN BOTTOM DEPOSITS (UG/KG DRY SOLIDS)	Min of Value	8.3
		Max of Value	57.2
		Average of Value	25.82
		Count of Value	5
	ENDOSULFAN IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.1
		Max of Value	0.2
		Average of Value	0.175
		Count of Value	4
	ENDOSULFAN SULFATE DRY WGTBOTUG/KG	Min of Value	7.57
		Max of Value	28.6
		Average of Value	15.074
		Count of Value	5
	ENDOSULFAN SULFATE TOTWUG/L	Min of Value	0.05
		Max of Value	0.2
		Average of Value	0.1125
		Count of Value	4
	ENDRIN IN BOTTOM DEPOS. (UG/KG DRY SOLIDS)	Min of Value	5
		Max of Value	57.3
		Average of Value	27.84
		Count of Value	5
	ENDRIN IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.1
		Max of Value	0.2
		Average of Value	0.175
		Count of Value	4
	ENTEROCOCI, ENTEROLERT, IDEXX, (MPN/100 ML)	Min of Value	2419
		Max of Value	2419
		Average of Value	2419
		Count of Value	1
	ETHANAMINE, N-ETHYL-N-NITROSO TOTW (UG/L)	Min of Value	5.3
		Max of Value	5.3
		Average of Value	5.3
		Count of Value	1
	ETHYLBENZENE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	ETHYLBENZENE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	FECAL COLIFORM,MEMBR FILTER,M-FC BROTH, #/100ML	Min of Value	1
		Max of Value	800
		Average of Value	74.5
		Count of Value	30
	FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	Min of Value	0.21
		Max of Value	0.21
		Average of Value	0.21
		Count of Value	1
	FLOW MTH 1=Gage Station 2=Elec 3=Mech 4=Weir/Flu	Min of Value	2
		Max of Value	2

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13782	FLOW MTH 1=Gage Station 2=Elec 3=Mech 4=Weir/Flu	Average of Value	2
		Count of Value	1
	FLOW:1=No Flow,2=Low,3=Normal,4=Flood,5=High,6=D	Min of Value	3
		Max of Value	5
		Average of Value	3.25
		Count of Value	8
	FLUORANTHENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	FLUORANTHENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	FLUORENE DRY WGTBOTUG/KG	Min of Value	14
		Max of Value	2799
		Average of Value	1570.38
		Count of Value	5
	FLUORENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	GAMMA BHC (LINDANE), SEDIMENT, DRY WT (UG/KG)	Min of Value	1.7
		Max of Value	28.6
		Average of Value	13.754
		Count of Value	5
	GUTHION IN BOTTOM DEPOSITS (UG/KG DRY SOLIDS)	Min of Value	50
		Max of Value	250
		Average of Value	123.5
		Count of Value	4
	GUTHION IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.5
		Max of Value	3
		Average of Value	1.125
		Count of Value	4
	HARDNESS, DISSOLVED, CALCULATED (MG/L AS CaCO3)	Min of Value	1710
		Max of Value	2080
		Average of Value	1913.333333
		Count of Value	3
	HEPTACHLOR EPOXIDE IN BOT. DEP. (UG/KG DRY SOL.)	Min of Value	3.3
		Max of Value	28.6
		Average of Value	14.074
		Count of Value	5
	HEPTACHLOR EPOXIDE IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.05
		Max of Value	0.1
		Average of Value	0.0775
		Count of Value	4
	HEPTACHLOR IN BOT. DEP. (UG/KG DRY SOLIDS)	Min of Value	1.7
		Max of Value	28.6
		Average of Value	13.754
		Count of Value	5
	HEPTACHLOR IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.02
		Max of Value	0.1
		Average of Value	0.0675
		Count of Value	4
	HEXACHLOROBENZENE IN BOT DEPOS (UG/KG DRY SOLIDS	Min of Value	1.7
		Max of Value	2799
		Average of Value	1170.58
		Count of Value	5
	HEXACHLOROBENZENE IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.02
		Max of Value	5.5
		Average of Value	3.955
		Count of Value	4
	HEXACHLOROBUTADIENE BOT. DEPOS. (UG/KG DRY WGT)	Min of Value	791.7
		Max of Value	4100
		Average of Value	2267.58
		Count of Value	5
	HEXACHLOROBUTADIENE TOTWUG/L	Min of Value	5
		Max of Value	11
		Average of Value	6.7
		Count of Value	4
	HEXACHLOROCYCLOPENTADIENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	8200
		Average of Value	3087.58
		Count of Value	5
	HEXACHLOROCYCLOPENTADIENE TOTWUG/L	Min of Value	5
		Max of Value	21
		Average of Value	9.2
		Count of Value	4
	HEXACHLOROETHANE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	HEXACHLOROETHANE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275

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13782	HEXACHLOROETHANE TOTWUG/L	Count of Value	4
	INDENO (1,2,3-CD) PYRENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	INDENO (1,2,3-CD) PYRENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	ISOPHORONE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	ISOPHORONE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	LEAD IN BOTTOM DEPOSITS (MG/KG AS PB DRY WGT)	Min of Value	0.08
		Max of Value	6.36
		Average of Value	3.646
		Count of Value	5
	LEAD, DISSOLVED (UG/L AS PB)	Min of Value	1
		Max of Value	5
		Average of Value	2.333333333
		Count of Value	3
	LINDANE (GAMMA-BHC) IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.03
		Max of Value	0.1
		Average of Value	0.07
		Count of Value	4
	MAGNESIUM, DISSOLVED (MG/L AS MG)	Min of Value	287
		Max of Value	358
		Average of Value	321
		Count of Value	3
	MALATHION IN BOT. DEPOS. (UG/KG DRY SOLIDS)	Min of Value	17
		Max of Value	250
		Average of Value	102.2
		Count of Value	5
	MALATHION IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.4
		Max of Value	0.5
		Average of Value	0.475
		Count of Value	4
	MANGANESE IN BOTTOM DEPOSITS (MG/KG AS MN DRY WG	Min of Value	128
		Max of Value	15012.73
		Average of Value	3901.9325
		Count of Value	4
	MERCURY DISSOLVED, IN WATER (UG/L)	Min of Value	0.038
		Max of Value	0.116
		Average of Value	0.065666667
		Count of Value	3
	MERCURY, TOTAL (UG/L AS HG)	Min of Value	0.034
		Max of Value	0.456
		Average of Value	0.245
		Count of Value	2
	MERCURY,TOT. IN BOT. DEPOS. (MG/KG) AS HG DRY WG	Min of Value	0.0003
		Max of Value	0.085
		Average of Value	0.03066
		Count of Value	5
	METHOXYCHLOR IN BOTTOM DEPOSITS (UG/KG DRY SOL.)	Min of Value	15.1
		Max of Value	57.3
		Average of Value	31.84
		Count of Value	5
	METHOXYCHLOR IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.1
		Max of Value	0.5
		Average of Value	0.25
		Count of Value	4
	METHYLENE CHLORIDE DRY WGTBOTUG/KG	Min of Value	5.3
		Max of Value	530
		Average of Value	119.7
		Count of Value	5
	METHYLENE CHLORIDE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	MIREX SEDIMENT,DRY WT (UG/KG)	Min of Value	6.7
		Max of Value	6.7
		Average of Value	6.7
		Count of Value	1
	MIREX, TOTAL (UG/L)	Min of Value	0.2
		Max of Value	0.2
		Average of Value	0.2
		Count of Value	1
	NAPHTHALENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5

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Arroyo Colorad Tidal Station 13782 Sediment Table

13782	NAPHTHALENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	N-BUTYL BENZYL PHTHALATE, SEDIMENTS,DRY WGT,UG/K	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	N-BUTYL BENZYL PHTHALATE,WHOLE WATER,UG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	NICKEL, DISSOLVED (UG/L AS NI)	Min of Value	9
		Max of Value	11
		Average of Value	9.666666667
		Count of Value	3
	NICKEL, TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT)	Min of Value	0.02
		Max of Value	19.83
		Average of Value	7.596
		Count of Value	5
	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	Min of Value	0.03
		Max of Value	1.81
		Average of Value	0.834846154
		Count of Value	13
	NITROBENZENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	NITROBENZENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	NITROGEN KJELDAHL TOTAL BOTTOM DEP DRY WT MG/KG	Min of Value	857
		Max of Value	857
		Average of Value	857
		Count of Value	1
	NITROGEN, AMMONIA, TOTAL (MG/L AS N)	Min of Value	0.01
		Max of Value	0.74
		Average of Value	0.174884615
		Count of Value	26
	NITROGEN, KJELDAHL, TOTAL, (MG/L AS N)	Min of Value	0.34
		Max of Value	1.81
		Average of Value	1.290666667
		Count of Value	24
	N-NITROSODIETHYLAMINE, SED DRY WT (UG/KG)	Min of Value	2000
		Max of Value	2000
		Average of Value	2000
		Count of Value	1
	N-NITROSODIMETHYLAMINE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	N-NITROSODIMETHYLAMINE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	N-NITROSO-DI-N-BUTYLAMINE, DRY WT,SEDIMENT (UG/K	Min of Value	791.7
		Max of Value	2247.2
		Average of Value	1609.725
		Count of Value	4
	N-NITROSODI-N-BUTYLAMINE, TOTAL (UG/L)	Min of Value	5.3
		Max of Value	5.5
		Average of Value	5.366666667
		Count of Value	3
	N-NITROSODI-N-PROPYLAMINE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	N-NITROSO-DI-N-PROPYLAMINE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	N-NITROSODIPHENYLAMINE DRY WGTBOTUG/KG	Min of Value	14
		Max of Value	2799
		Average of Value	1570.38
		Count of Value	5
	N-NITROSODIPHENYLAMINE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	NO2 PLUS NO3-N, TOTAL, WHATMAN GF/F FILT (MG/L)	Min of Value	0.15
		Max of Value	2.79
		Average of Value	1.119090909
		Count of Value	11
	OIL & GREASE (FREON EXTR.-GRAV METH),BOT. DEPOS.	Min of Value	146

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13782	OIL & GREASE (FREON EXTR.-GRAV METH),BOT. DEPOS.	Max of Value	146
		Average of Value	146
		Count of Value	1
	OIL & GREASE (FREON EXTR.-IR METHOD),BOT. DEPOS.	Min of Value	130.2
		Max of Value	319.6
		Average of Value	232.8
		Count of Value	3
	OXYGEN, DISSOLVED (MG/L)	Min of Value	0.1
		Max of Value	13.14
		Average of Value	5.548367347
		Count of Value	98
	PARACHLOROMETA CRESOL DRY WGTBOTUG/KG	Min of Value	1400
		Max of Value	8200
		Average of Value	4800
		Count of Value	2
	PARACHLOROMETA CRESOL, TOTAL UG/L	Min of Value	21
		Max of Value	21
		Average of Value	21
		Count of Value	1
	PARATHION IN BOT. DEPOS. (UG/KG DRY SOLIDS)	Min of Value	17
		Max of Value	250
		Average of Value	102.2
		Count of Value	5
	PARATHION IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.25
		Max of Value	0.5
		Average of Value	0.4375
		Count of Value	4
	PCB - 1242 PCB SERIES WHOLE WATER SAMPLE (UG/L)	Min of Value	1
		Max of Value	1
		Average of Value	1
		Count of Value	1
	PCB 1254 IN BOTTOM DEPOS. (UG/KG DRY SOLIDS)	Min of Value	33
		Max of Value	33
		Average of Value	33
		Count of Value	1
	PCB-1016 IN BOTTOM SEDIMENTS DRY WT (UG/KG)	Min of Value	33
		Max of Value	33
		Average of Value	33
		Count of Value	1
	PCB-1016 TOTWUG/L	Min of Value	1
		Max of Value	1
		Average of Value	1
		Count of Value	1
	PCB-1221 BOT. DEP.,PCB SERIES DRY SOL UG/KG	Min of Value	33
		Max of Value	33
		Average of Value	33
		Count of Value	1
	PCB-1221 IN THE WHOLE WATER SAMPLE UG/L	Min of Value	1
		Max of Value	1
		Average of Value	1
		Count of Value	1
	PCB-1232 BOT. DEP.,PCB-SERIES DRY SOL (UG/KG)	Min of Value	33
		Max of Value	33
		Average of Value	33
		Count of Value	1
	PCB-1232 PCB SERIES WHOLE WATER SAMPLE (UG/L)	Min of Value	1
		Max of Value	1
		Average of Value	1
		Count of Value	1
	PCB-1242 BOT. DEP.,PCB-SERIES DRY SOL UG/KG	Min of Value	33
		Max of Value	33
		Average of Value	33
		Count of Value	1
	PCB-1248 IN BOTTOM DEPOS. (UG/KG DRY SOLIDS)	Min of Value	33
		Max of Value	33
		Average of Value	33
		Count of Value	1
	PCB-1248 PCB SERIES WHOLE WATER SAMPLE UG/L	Min of Value	1
		Max of Value	1
		Average of Value	1
		Count of Value	1
	PCB-1254 PCB SERIES WHOLE WATER SAMPLE (UG/L)	Min of Value	1
		Max of Value	1
		Average of Value	1
		Count of Value	1
	PCB-1260 IN BOTTOM DEPOS. DRY SOLIDS (UG/KG)	Min of Value	33
		Max of Value	33
		Average of Value	33
		Count of Value	1
	PCB-1260 PCB SERIES WHOLE WATER SAMPLE (UG/L)	Min of Value	1
		Max of Value	1
		Average of Value	1
		Count of Value	1
	PCBS IN BOTTOM DEPOSITS (UG/KG DRY SOLIDS)	Min of Value	33
		Max of Value	286

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Arroyo Colorad Tidal Station 13782 Sediment Table

13782	PCBS IN BOTTOM DEPOSITS (UG/KG DRY SOLIDS)	Average of Value	140.74
		Count of Value	5
	PCBS IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.5
		Max of Value	1
		Average of Value	0.875
		Count of Value	4
	PCP (PENTACHLOROPHENOL) IN BOT DEPOS DRY UG/KG	Min of Value	6.4
		Max of Value	8200
		Average of Value	3976.42
		Count of Value	5
	PCP (PENTACHLOROPHENOL) WHOLE WATER SAMPLE UG/L	Min of Value	10
		Max of Value	21
		Average of Value	13.15
		Count of Value	4
	PENTACHLOROBENZENE IN SEDIMENT UG/KG	Min of Value	1.7
		Max of Value	2799
		Average of Value	1447.92
		Count of Value	5
	PENTACHLOROBENZENE WHOLE WATER (UG/L)	Min of Value	0.02
		Max of Value	5.5
		Average of Value	3.955
		Count of Value	4
	PH (STANDARD UNITS)	Min of Value	7.5
		Max of Value	9.17
		Average of Value	8.189680851
		Count of Value	94
	PHENANTHRENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	PHENANTHRENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	PHENOL (C6H50H)-SINGLE COMPOUND, TOTAL UG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	PHENOL(C6H5OH)-SINGLE COMPOUND DRY WGTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	PHEOPHYTIN-A UG/L SPECTROPHOTOMETRIC ACID. METH.	Min of Value	0
		Max of Value	25.9
		Average of Value	8.143076923
		Count of Value	26
	PHOSPHORUS, DISSOLVED ORTHOPHOSPHORUS(MG/L AS P)	Min of Value	0.03
		Max of Value	0.34
		Average of Value	0.177384615
		Count of Value	13
	PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	Min of Value	0.15
		Max of Value	0.66
		Average of Value	0.328692308
		Count of Value	26
	PHOSPHORUS,IN TOTAL ORTHOPHOSPHATE (MG/L AS P)	Min of Value	0.06
		Max of Value	0.3
		Average of Value	0.185454545
		Count of Value	11
	PHOSPHORUS,TOTAL, BOTTOM DEPOSIT (MG/KG DRY WGT)	Min of Value	517
		Max of Value	517
		Average of Value	517
		Count of Value	1
	PYRENE DRY WGTBOTUG/KG	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	PYRENE TOTWUG/L	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	PYRIDINE SEDIMENT DRY WEIGHT (UG/KG)	Min of Value	791.7
		Max of Value	2799
		Average of Value	1847.58
		Count of Value	5
	PYRIDINE WHOLE WATER (UG/L)	Min of Value	5
		Max of Value	5.5
		Average of Value	5.275
		Count of Value	4
	RESIDUE, TOTAL NONFILTRABLE (MG/L)	Min of Value	8
		Max of Value	112
		Average of Value	29.84615385
		Count of Value	26
	RESIDUE, VOLATILE NONFILTRABLE (MG/L)	Min of Value	1
		Max of Value	24
		Average of Value	8.615384615

Appendix A
Arroyo Colorad Tidal Station 13782 Sediment Table

13782	RESIDUE, VOLATILE NONFILTRABLE (MG/L)	Count of Value	26
	RESIDUE,TOTAL FILTRABLE (DRIED AT 180C) (MG/L)	Min of Value	7210
		Max of Value	23100
		Average of Value	13767.76923
		Count of Value	26
	SALINITY - PARTS PER THOUSAND	Min of Value	3.8
		Max of Value	40.7
		Average of Value	19.4672093
		Count of Value	86
	SEDIMENT PRCTL.SIZE CLASS <.0039 CLAY %DRY WT	Min of Value	8
		Max of Value	54
		Average of Value	22.962
		Count of Value	5
	SEDIMENT PRCTL.SIZE CLASS,SAND .0625-2MM %DRY W	Min of Value	18
		Max of Value	82
		Average of Value	58.57
		Count of Value	5
	SEDIMENT PRTCL.SIZE CLASS >2.0MM GRAVEL %DRY WT	Min of Value	0
		Max of Value	1
		Average of Value	0.22
		Count of Value	5
	SEDIMENT PRTL.SIZE CLASS.0039-.0625 SILT %DRY W	Min of Value	9.34
		Max of Value	32
		Average of Value	18.268
		Count of Value	5
	SELENIUM IN BOTTOM DEPOSITS (MG/KG AS SE DRY WT)	Min of Value	0.05
		Max of Value	4.78
		Average of Value	1.1062
		Count of Value	5
	SELENIUM, DISSOLVED (UG/L AS SE)	Min of Value	6.82
		Max of Value	35
		Average of Value	17.27333333
		Count of Value	3
	SEVIN IN SEDIMENT DRY WEIGHT (UG/KG)	Min of Value	791.7
		Max of Value	2799
		Average of Value	1809.475
		Count of Value	4
	SEVIN IN WHOLE WATER SAMPLE (UG/L)	Min of Value	5
		Max of Value	5.5
		Average of Value	5.266666667
		Count of Value	3
	SILVER IN BOTTOM DEPOSITS (MG/KG AS AG DRY WGT)	Min of Value	0.01
		Max of Value	0.75
		Average of Value	0.38
		Count of Value	5
	SILVER, DISSOLVED (UG/L AS AG)	Min of Value	0.5
		Max of Value	2.5
		Average of Value	1.166666667
		Count of Value	3
	SILVEX IN BOTTOM DEPOSITS (UG/KG DRY SOLIDS)	Min of Value	0.6
		Max of Value	17
		Average of Value	5.382
		Count of Value	5
	SILVEX IN WHOLE WATER SAMPLE (UG/L)	Min of Value	0.05
		Max of Value	5
		Average of Value	1.325
		Count of Value	4
	SIMULTANEOUSLY EXTRACTED METALS,SUM(SEM) (MMOL/K	Min of Value	0.131
		Max of Value	0.131
		Average of Value	0.131
		Count of Value	1
	SOLIDS IN SEDIMENT, PERCENT BY WEIGHT (DRY)	Min of Value	27.19
		Max of Value	69.94
		Average of Value	51.924
		Count of Value	5
	SPECIFIC CONDUCTANCE,FIELD (UMHOS/CM @ 25C)	Min of Value	6930
		Max of Value	60640
		Average of Value	30449.46078
		Count of Value	102
	SULFATE (MG/L AS SO4)	Min of Value	706
		Max of Value	2310
		Average of Value	1421.865385
		Count of Value	26
	SULFIDE IN BOTTOM DEPOSITS MG/KG	Min of Value	23.1
		Max of Value	843.5
		Average of Value	239.65
		Count of Value	4
	TEMPERATURE, WATER (DEGREES CENTIGRADE)	Min of Value	17.9
		Max of Value	31.4
		Average of Value	25.46029412
		Count of Value	102
	TETRACHLOROETHYLENE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5

Appendix A
Arroyo Colorad Tidal Station 13782 Sediment Table

13782	TETRACHLOROETHYLENE TOTWUG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	TOLUENE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	TOLUENE IN WTR SMPLE GC-MS, HEXADECONE EXTR.UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	TOTAL ORGANIC CARBON IN SEDIMENT DRY WGT (MG/KG)	Min of Value	1000
		Max of Value	23000
		Average of Value	11488
		Count of Value	5
	TOXAPHENE IN BOTTOM DEPOS.(UG/KG DRY SOLIDS)	Min of Value	83
		Max of Value	573
		Average of Value	285
		Count of Value	5
	TOXAPHENE IN WHOLE WATER SAMPLE (UG/L)	Min of Value	1
		Max of Value	5
		Average of Value	2.5
		Count of Value	4
	TRANS-1,2-DICHLOROETHENE, IN SED. DRY WT. UG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	TRANS-1,2-DICHLOROETHENE, TOTAL, IN WATER UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	TRANS-1,3-DICHLOROPROPENE SEDIMENT DRY WGT UG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	TRANS-1,3-DICHLOROPROPENETOTAL IN WATER UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	TRANSPARENCY, SECCHI DISC (METERS)	Min of Value	0.3
		Max of Value	1.8
		Average of Value	0.652068966
		Count of Value	29
	TRICHLOROETHYLENE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	530
		Average of Value	114.02
		Count of Value	5
	TRICHLOROETHYLENE-WHOLE WATER SAMPLE-UG/L	Min of Value	2
		Max of Value	5
		Average of Value	4.25
		Count of Value	4
	VINYL CHLORIDE DRY WGTBOTUG/KG	Min of Value	5
		Max of Value	1300
		Average of Value	268.02
		Count of Value	5
	VINYL CHLORIDE-WHOLE WATER SAMPLE-UG/L	Min of Value	5
		Max of Value	5
		Average of Value	5
		Count of Value	4
	XYLENE SEDIMENT, DRY WGT (UG/KG)	Min of Value	15
		Max of Value	1600
		Average of Value	423.325
		Count of Value	4
	XYLENE WHL WATER SMPL (UG/L)	Min of Value	5
		Max of Value	15
		Average of Value	10.25
		Count of Value	4
	ZINC IN BOTTOM DEPOSITS (MG/KG AS ZN DRY WGT)	Min of Value	0.01
		Max of Value	38.2
		Average of Value	20.0525
		Count of Value	4
	ZINC, DISSOLVED (UG/L AS ZN)	Min of Value	3
		Max of Value	4
		Average of Value	3.333333333
		Count of Value	3
13782 Min of Value			0
13782 Max of Value			60640
13782 Average of Value			2097.769121
13782 Count of Value			2160
Total Min of Value			0
Total Max of Value			60640
Total Average of Value			2097.769121
Total Count of Value			2160

APPENDIX B
PHOTO LOG

Segment 2201, Station 13782, Taking water quality readings at Arroyo Colorado Tidal at FM 106 Bridge at Rio Hondo (2001).

Segment 2201, Station 13782, Taking water quality readings at Arroyo Colorado Tidal at FM 106 Bridge at Rio Hondo (2001).

Segment 2201, Station 13071, Approaching sample station on Arroyo Colorado Tidal (2001).

Segment 2201, Station 13071, Sediment sampling from zodiac on Arroyo Colorado Tidal (2001).

Segment 2201, Station 13071, Departing station (to left of lighted dock) on Arroyo Colorado Tidal (2001).

Segment 2201, Station 13072, Approaching sample station (off this corner of the tributary) on Arroyo Colorado Tidal (2001).

Segment 2201, Station 13072, Sampling (approximately 20 yards from bank*) on Arroyo Colorado Tidal (2001).

* Sampling is consistent with historical sampling conducted by the state.

APPENDIX C
TOXICITY TESTS LABORATORY REPORTS AND DATA SUMMARY

10 Day Sediment Toxicity Screens Exposing
Leptocheirus plumulosus **and** Neanthes arenaceodentata
to Sediments from Segments 1007A and 2201

Submitted to:

Randy Palachek
Parsons ES
8000 Centre Park Drive, Suite200
Austin, Texas 78754-5140

Submitted by:

TRAC Laboratories, Inc.
14 South 2nd Street
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Florida Department of Health and Rehabilitative Services
Certification Number E81181

Project: TCEQ TMDL
Subcontract Number: 739598.3000-00
Sampling Event Numbers: 1-6

August 2001

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2. Summary of Sampling Event 1: Sample Collection Dates, Test Dates and Survival Data.
3. Summary of Sampling Event 2: Sample Collection Dates, Test Dates and Survival Data.
4. Summary of Sampling Event 3: Sample Collection Dates, Test Dates and Survival Data.
5. Summary of Sampling Event 4: Sample Collection Dates, Test Dates and Survival Data.
6. Summary of Sampling Event 5: Sample Collection Dates, Test Dates and Survival Data.
7. Summary of Sampling Event 6: Sample Collection Dates, Test Dates and Survival Data.

Toxicity Test Summary Sheet

Client:	Parsons ES
Subcontract Num:	739598.3000-00
Study Director:	Dan Johnson
Test Material:	Whole sediment samples from Segments 1007A(Vince Bayou) and 2201 (Arroyo Colorado Tidal).
Date Materials Collected:	20 April through 10 August 2001
Date of Tests:	4 May through 27 August 2001
Test Conditions:	Static, 10 day duration.
Test Procedures:	1994. U.S. EPA. (EPA/600/R-94/025). Methods for Assessing the Toxicity of Sediment-associated Contaminants With Estuarine and Marine Amphipods. 1998. U.S. EPA. (EPA 823-B-98-004). Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual.
Test Organisms:	*Neanthes arenaceodentata* and *Leptocheirus plumulosus*
Source:	*N. arenaceodentata* were supplied by Dr. Don Reish, California State, Long Beach. *L. plumulosus* were supplied by Chesapeake Cultures.
Control and Dilution Water:	Natural sea water at a salinity of 30 parts per thousand (ppt) for *N. arenaceodentata* tests and 20 ppt for *L. plumulosus* tests.
Exposure Concentration:	100% sediment.
Effect Criteria:	Survival.

INTRODUCTION

Sediments samples tested in this study are part of the TCEQ TMDL study. This study represents testing of 6 sampling events. Sediment samples form segment 1007A and 2201 were received from Parsons personnel and tested at TRAC Laboratories Inc., Pensacola, Florida, to determine acute effects to *Neanthes arenaceodentata* and *Leptocheirus plumulosus*. The criterion for effect was survival. Tests were conducted from 4 May through 27 August 2001. All raw data related to this study are stored at TRAC. Data are presented as hard copy data files in Excel worksheet format.

MATERIALS AND METHODS

Test Material

Sediment samples were obtained from Parsons by TRAC personnel via Federal Express. The samples were contained in 3.5 gallon plastic buckets or 1 gallon high density polyethylene jars.

A chain of custody form accompanied each sediment shipment. Sample label information was recorded in the sediment receiving log as was arrival temperature and the date received at TRAC Laboratories in Pensacola, Florida.

Sample identification, approximate volume, sieve size used for press-sieving, date of receipt and processing data were recorded in the sample log prior to test initiation.

Four samples were tested from each segment. Samples from segment 1007A (Vince Bayou) were labeled as: 14368, 11299, 14371 and a duplicate. Samples from segment 2201 (Arroyo Colorado Tidal) were labeled as: 13071, 13782, 13072 and 2201-Duplicate. Sampling and testing dates are included in Data files 2-7.

Control Water

Natural sea water collected from the Gulf of Mexico was cleaned and conditioned by running it through a sand filter continuously times. The conditioned water was then adjusted to salinities of 30ppt for *N. arenaceodentata* exposures and 20ppt for *L. plumulosus* exposures using deionized water. The salinity adjusted and conditioned water was then acclimated to the test temperature of 20^{o}C. This treated water was then used for overlying water in the sediment exposures and positive control reference toxicant tests.

Test Animals

Neanthes arenaceodentata were obtained from Dr. Don Reish, California State University, Long Beach. The *N. arenaceodentata* were juveniles, 2-3 weeks in age.

Leptocheirus plumulosus were obtained from Chesapeake Cultures, Inc., Hayes, Virginia and were 2-4 mm in length.

Animals were shipped (via overnight courier) in their native sediment with overlying natural sea water. Upon arrival, temperature and salinity were noted, water was exchanged and renewed with fresh control water for acclimation to test conditions.

Test Conditions

Tests were conducted in a temperature-controlled (20 ± 2^{0}C) environmental chamber under a 24-hour light photo period. Daily animal observations were conducted and any dead organisms or molts were removed. Live *L. plumulosus* and *N. arenaceodentata* found floating during the test period were gently submerged with a pipet and allowed a 15 minute period for burrowing before replacing airlines. Each replicate was gently aerated (~100 bubbles/minute) throughout the 10-day test, and frequent daily checks insured airlines were aerating the water column.

Sediment Preparation

Sediment samples were press sieved through a 1.0 mm stainless steel sieve to remove particles and predators which might interfere with the testing process. The complete contents of each sample, including the sediment porewater, were captured and used to aid the sample in passing through the sieve.

Following the press sieving step and prior to test initiation, sediments were homogenized by blending the sediment 3 - 5 minutes with a stainless steel spoon or mechanical paddle.

Once homogenized, the sediments were measured out in 200 ml aliquots and transferred to randomly assigned one liter glass jars. Six replicates were measured out for each sediment sample. Five replicates were set up for the 10 day exposures and the sixth replicate was used to measure porewater ammonia.

Test Initiation

The randomly assigned jars containing exposure sediments were placed in the environmental chamber in numerical order. Seven hundred fifty ml of natural seawater diluted to 30ppt or 20ppt were carefully poured over a turbidity reducer to fill the test vessel. The exposure vessels were then allowed to settle 14-16 hours before test organisms were introduced.

After the settling period, physical parameters (pH, DO, temperature and salinity) were monitored and recorded on the physical data sheets prior to introduction of test organisms.

Once acclimated to laboratory conditions (Salinity, temperature and lighting), test organisms were removed from the native sediment and prepared for test sorting. *L. plumulosus* 2 - 4 mm in length were selected individually with a medium bore pipette and transferred to a 30 ml beaker containing prepared 20ppt seawater. Ten *L. plumulosus* were collected in each beaker and observed for good color, full gut, and size.

Two beakers of 10 animals were combined and added in random sequence to each exposure vessel, releasing 20 *L. plumulosus* into the sediment exposure. Two extra beakers with ten animals each were randomly selected for size measurements at test initiation and recorded on the day 0 setup sheet.

N. arenaceodentata were gently agitated with a pipet to remove them from tubes. Five worms were placed in a 30 ml beaker containing 10 ml of 30ppt seawater and then added in random sequence to each sediment replicate.

One hour after addition of test organisms, each sediment replicate was examined to ensure all animals were established in the sediment and air lines replaced.

Ammonia Analysis

The sixth replicate was brought into the environmental chamber with the 10-day sediment exposures and treated the same (aerated) as the other five replicates. A fritted glass sampler was placed approximately 2.0 cm into the sediment prior to addition of overlying water. Hydrostatic pressure forced interstitial water into the sampler after passing through a 1.0 μ pore glass fiber filter (Gelman Sciences, type A/E) which was wrapped around the fritted portion of the sampler to prevent clogging.

Ten to twenty ml of interstitial water were removed from the neck of the fritted sampler

16-20 hours into the test (day 0). Temperature, salinity and pH measurements were recorded prior to the total ammonia analysis. The Orion 250A pH/ISE meter and 95-12 gas-sensing ammonia electrode measured the ammonia ion after conversion to ammonia gas. Sample color and turbidity do not affect measurements by this method. Other ionic species do not interfere with this probe. The ammonia-selective electrode method (4500-NH_3, ASTM 13th Edition, 1992) was followed by raising each sample's pH to above 11 with 10 N NaOH, and measuring ammonia across the probe's membrane as it is converted from aqueous NH_3 and NH_4^+. Potentiometric measurements were recorded for each sample in millivolts (mV) and extrapolated to mg/L of total ammonia from a standard curve constructed with each test series.

A standard ammonia curve was constructed for each test series using four standards (0.1, 1.0, 10 and 100 mg/L) diluted from a 1000 mg/L stock of ammonia. The log transformed standard concentrations were entered into a linear regression with their potentiometric responses (mV) yielding correlations of 98 to 100%. All sample measurements were then entered into this same formula to retrieve a total ammonia measurement in mg/L.

In each test series, DI water blanks were measured to calibrate a zero-ammonia point for the probe. When enough sample was available, a sample was duplicated to measure variation. Total ammonia concentrations for each sample ID are presented as Data File 1.

Test Termination

Sediment tests were terminated after 10 days. Sediment vessels were removed in numerical order from the environmental chamber animal recovery. Sediments and overlying water were passed through a 250 micron mesh sieve which was designed to capture the test organisms while allowing some sediments to pass through. Because of time constraints due to the number of exposure replicates, all material retained in the sieve was preserved in a 70% ethanol solution with rose Bengal stain. Organisms were later recovered and counted from the preserved exposures and recorded on the breakdown sheet. Once all exposure replicates were broken down and picked, the data was grouped according to the sediment ID. The randomization sheet was used to unscramble the exposure vessel numbers which in turn accounted for the five replicates. The descrambling sheet provides sample ID matched to randomized vessel numbers.

Reference Toxicant (Positive Control)

A positive control "reference toxicant" test was conducted with each shipment of test organisms. The reference toxicant used was sodium dodecyl sulfate (SDS) and the test was conducted in accordance with EPA/600/4-90/027F and EPA/620/R-95/008. Values were plotted to determine if the results were within prescribed limits. In this technique, a running plot is maintained for the toxicity values from successive tests with a given reference toxicant. For regression analysis results (i.e. LC50s), the mean (x) and upper and lower control limits ($\pm$2SD) are recalculated with each successive point until the statistics stabilize. Control charts are presented as figures 1 and 2.

Reference Sediment (Negative Control)

All sediment tests were accompanied by a negative control reference sediment test. Replication of these control samples were the same as for the study site samples (five exposure replicates; one replicate for ammonia analysis). Negative control reference sediment (C-17) was obtained by TRAC personnel from Perdido Bay at position 30^0 19.753' N, 087^0 27.869' W. The principal reason for selecting C-17 as a suitable reference sediment is in the toxicological data base developed for *A. abdita* by USEPA's EMAP Louisianian Province in previous years (1990-1994).

Statistical Analysis

The sediment samples were tested in groups of six and seven with a common negative control. ANOVA and Dunnett's multiple range tests were used to identify samples in which survival was statistically lower from the negative controls. The survival proportions were transformed using Arcsin ($\sqrt{p2_i}$) where p_i = proportion surviving in replicate I. The data was then examined for homogeneity of variance and departure from normality using Bartlett's and Shapiro-Wilks tests, respectively. If the data were normally distributed and the variances homogenous, the transformed data was analyzed with a one-way ANOVA. If the F test of the ANOVA was significant ($p<0.05$), differences between the mean of each sample were compared with the control using Dunnett's test. Dunnett's test is specifically intended to compare treatment means with a control. If the F test in the ANOVA is not significant, no further analysis is performed, and the sample means are then statistically similar to the control. When the assumptions of normality and variance homogeneity cannot be verified, Steel's Many One Rank Test is used to examine differences between the control and each mean. Steel's Test is specifically intended to examine differences between treatments and a control when assumptions of normality and variance homogeneity cannot be verified.

RESULTS AND DISCUSSION

Survival Information

Survival data was calculated for each replicate as percent survival; mean and standard deviation were calculated for each sample.

Statistical analysis was performed as defined above. Based on data analysis, significant reductions in survival of both species were measured in sample 14368 (segment 1007A, Vince Bayou) only. Whole sediment tests of samples from segment 1007A were conducted in the first two sampling events only. Once consistent toxicity was observed in sample 14368 from segment 1007A, testing efforts for that site shifted to TIE procedures involving porewater. However, whole sediment testing of samples from site 2201 continued through 6 events with no observed toxicity. Complete survival data are displayed in Data Files 2-7.

Physical Parameters

Salinity, dissolved oxygen and pH were measured in each test replicate on days 0, 4, 7 and 10. Temperature was measured in each exposure replicate daily and were consistently 20^{o}C $\pm$2^{o}C. Dissolved oxygen levels were maintained with gentle aeration throughout the ten day exposure and levels stayed above 60% of saturation.

Figure 1. *Leptocheirus plumulosus* Acute Control Chart

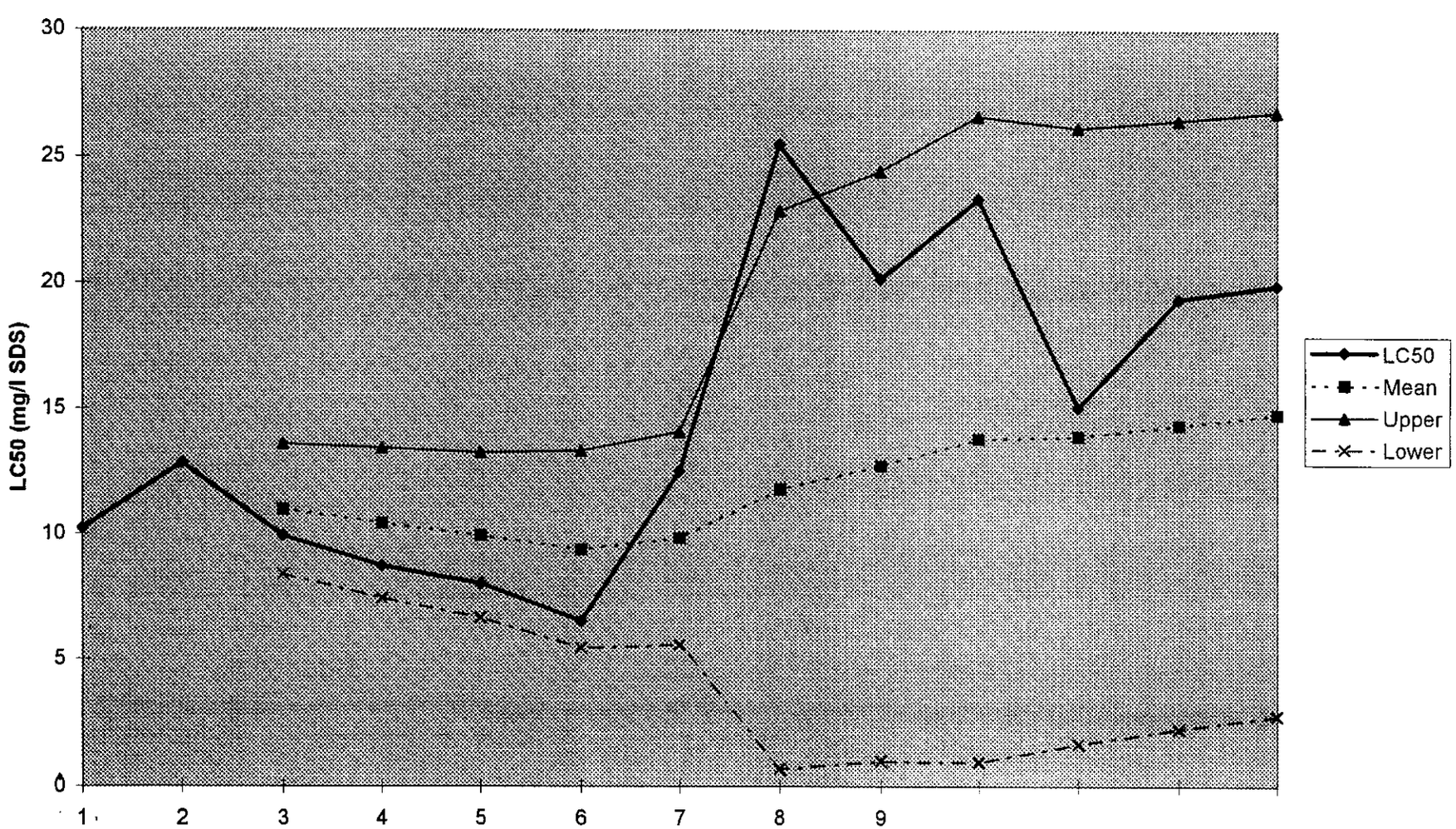
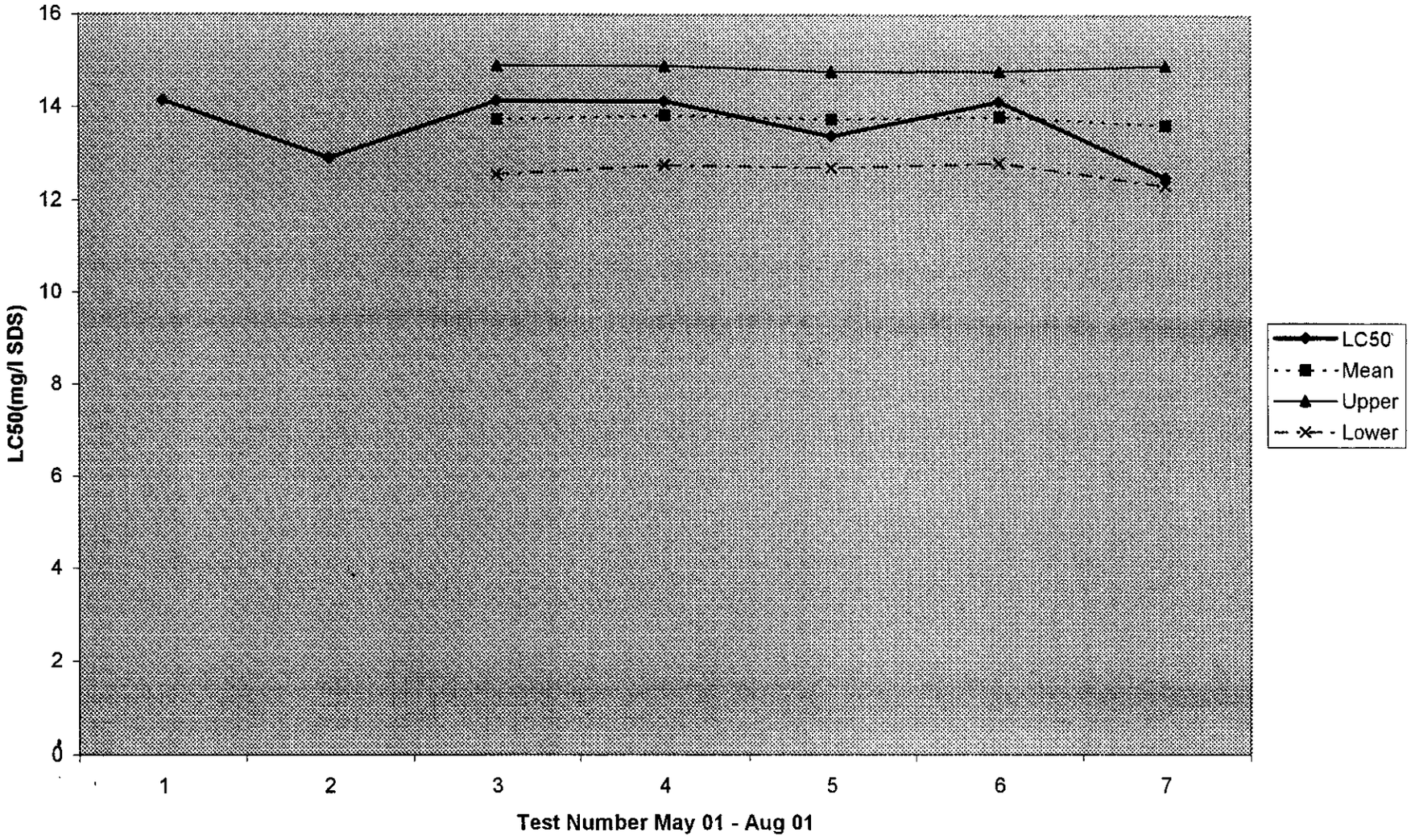


Figure 2. *Neanthes arenaceodentata* Acute Control Chart



DATA FILE 1

Total Ammonia
Measurements from Interstitial Water

Ammonia Analyses

Sample ID	Segment	Event	Total Ammonia (mg/L)	Temp (^{0}C)
13782	2201	1	2.75	20
13072	2201	1	2.45	20
13071	2201	1	1.44	20
2201-DUPL	2201	1	2.95	20
13782	2201	2	0.43	20
13072	2201	2	0.32	20
13071	2201	2	0.35	20
2201-DUPL	2201	2	0.12	20
13782	2201	3	0.36	20
13072	2201	3	0.6	20
13071	2201	3	0.35	20
2201-DUPL	2201	3	0.57	20
13782	2201	4	1.12	20
13072	2201	4	0.85	20
13071	2201	4	0.78	20
2201-DUPL	2201	4	0.92	20
13782	2201	5	0.98	20
13072	2201	5	0.52	20
13071	2201	5	0.74	20
2201-DUPL	2201	5	0.66	20
13782	2201	6	2.75	20
13072	2201	6	0.89	20
13071	2201	6	2.51	20
2201-DUPL	2201	6	2.69	20

DATA FILE 2

Summary of Sampling Event 1:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 4-14 May 2001

Samples Collected April 25, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	20	100	99	2.24	0.05	N/A
	20	100				
	19	95				
	20	100				
	20	100				
13782-1	20	100	100	0.00	0.05	NO
	20	100				
	20	100				
	20	100				
	20	100				
13071-1	20	100	100	0.00	0.05	NO
	20	100				
	20	100				
	20	100				
	20	100				
13072-1	20	100	97	6.71	0.05	NO
	20	100				
	20	100				
	17	85				
	20	100				
2201-DUPL	20	100	99	2.24	0.05	NO
	20	100				
	20	100				
	19	95				
	20	100				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 4-14 May 2001

Samples Collected April 25, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	5	100	100	0.00	0.05	N/A
	5	100				
	5	100				
	5	100				
	5	100				
13782-1	5	100	96	8.94	0.05	NO
	5	100				
	5	100				
	5	100				
	4	80				
13071-1	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
13072-1	4	80	92	10.95	0.05	NO
	4	80				
	5	100				
	5	100				
	5	100				
2201-DUPL	4	80	92	10.95	0.05	NO
	5	100				
	4	80				
	5	100				
	5	100				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

DATA FILE 3

Summary of Sampling Event 2:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 5-15 June 2001

Samples Collected May 21-22, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	15	75	90	9.35	0.05	N/A
	18	90				
	20	100				
	18	90				
	19	95				
13782-2	17	85	85	3.54	0.05	NO
	18	90				
	16	80				
	17	85				
	17	85				
13071-2	18	90	96	5.48	0.05	NO
	20	100				
	20	100				
	18	90				
	20	100				
13072-2	17	85	87	7.58	0.05	NO
	16	80				
	19	95				
	19	95				
	16	80				
2201-DUPL-2	17	85	88	4.47	0.05	NO
	17	85				
	18	90				
	17	85				
	19	95				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-2

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 5-15 June 2001

Samples Collected May 21-22, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	4	80	96	8.94	0.05	N/A
	5	100				
	5	100				
	5	100				
	5	100				
13782-2	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
13071-2	4	80	92	10.95	0.05	NO
	5	100				
	5	100				
	4	80				
	5	100				
13072-2	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
2201-DUPL-2	5	100	96	8.94	0.05	NO
	5	100				
	5	100				
	4	80				
	5	100				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-2

DATA FILE 4

Summary of Sampling Event 3:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 15-25 June 2001

Samples Collected June 11, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	15	75	90	8.66	0.05	N/A
	19	95				
	19	95				
	18	90				
	19	95				
13782-3	13	65	75	11.73	0.05	NO
	14	70				
	14	70				
	15	75				
	19	95				
13071-3	18	90	96	5.48	0.05	NO
	20	100				
	18	90				
	20	100				
	20	100				
13072-3	16	80	79	9.62	0.05	NO
	15	75				
	17	85				
	13	65				
	18	90				
2201-DUPL-3	13	65	80	15.00	0.05	NO
	16	80				
	19	95				
	13	65				
	19	95				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-3

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 15-25 June 2001

Samples Collected June 11, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	5	100	92	10.95	0.05	N/A
	4	80				
	5	100				
	5	100				
	4	80				
13782-3	4	80	88	17.89	0.05	NO
	5	100				
	3	60				
	5	100				
	5	100				
13071-3	4	80	96	8.94	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
13072-3	4	80	88	17.89	0.05	NO
	3	60				
	5	100				
	5	100				
	5	100				
2201-DUPL-3	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-3

DATA FILE 5

Summary of Sampling Event 4:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 29 June - 9 July 2001

Samples Collected June 22, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	19	95	95	3.54	0.05	N/A
	20	100				
	19	95				
	19	95				
	18	90				
13782-4	18	90	90	12.25	0.05	NO
	14	70				
	20	100				
	20	100				
	18	90				
13071-4	20	100	97	2.74	0.05	NO
	19	95				
	19	95				
	20	100				
	19	95				
13072-4	20	100	96	6.52	0.05	NO
	17	85				
	20	100				
	19	95				
	20	100				
2201-DUPL-4	20	100	97	4.47	0.05	NO
	20	100				
	20	100				
	18	90				
	19	95				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-4

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 29 June - 9 July 2001

Samples Collected June 22, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	5	100	92	10.95	0.05	N/A
	5	100				
	5	100				
	4	80				
	4	80				
13782-4	5	100	92	10.95	0.05	NO
	5	100				
	5	100				
	4	80				
	4	80				
13071-4	3	60	92	17.89	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
13072-4	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
2201-DUPL-4	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-4

DATA FILE 6

Summary of Sampling Event 5:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 27 July - 6 August 2001

Samples Collected July 20, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	20	100	99	2.24	0.05	N/A
	20	100				
	20	100				
	19	95				
	20	100				
13782-5	20	100	99	2.24	0.05	NO
	20	100				
	20	100				
	20	100				
	19	95				
13071-5	20	100	99	2.24	0.05	NO
	20	100				
	19	95				
	20	100				
	20	100				
13072-5	20	100	96	4.18	0.05	NO
	20	100				
	19	95				
	19	95				
	18	90				
2201-DUPL-5	20	100	98	2.74	0.05	NO
	19	95				
	20	100				
	20	100				
	19	95				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-5

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 27 July - 8 August 2001

Samples Collected July 20, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	5	100	100	0.00	0.05	N/A
	5	100				
	5	100				
	5	100				
	5	100				
13782-5	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
13071-5	5	100	96	8.94	0.05	NO
	4	80				
	5	100				
	5	100				
	5	100				
13072-5	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
2201-DUPL-5	4	80	88	17.89	0.05	NO
	5	100				
	5	100				
	5	100				
	3	60				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-5

DATA FILE 7

Summary of Sampling Event 6:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 17 - 27 August 2001

Samples Collected August 10, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	20	100	99	2.24	0.05	N/A
	20	100				
	19	95				
	20	100				
	20	100				
13782-6	19	95	95	5.00	0.05	NO
	20	100				
	18	90				
	18	90				
	20	100				
13071-6	20	100	98	2.74	0.05	NO
	20	100				
	19	95				
	19	95				
	20	100				
13072-6	20	100	98	2.74	0.05	NO
	19	95				
	20	100				
	20	100				
	19	95				
2201-DUPL-6	18	90	97	4.47	0.05	NO
	20	100				
	20	100				
	20	100				
	19	95				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-6

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 17 - 27 August 2001

Samples Collected August 10, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference
C17 (Control)	4	80	96	8.94	0.05	N/A
	5	100				
	5	100				
	5	100				
	5	100				
13782-6	4	80	88	17.89	0.05	NO
	5	100				
	3	60				
	5	100				
	5	100				
13071-6	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
13072-6	5	100	100	0.00	0.05	NO
	5	100				
	5	100				
	5	100				
	5	100				
2201-DUPL-6	5	100	92	10.95	0.05	NO
	4	80				
	5	100				
	4	80				
	5	100				

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL-6

10 Day Sediment Toxicity Screens Exposing
Leptocheirus plumulosus* and *Neanthes arenaceodentata
to Sediments from Segment 2201

Submitted to:

Randy Palachek
Parsons ES
8000 Centre Park Drive, Suite 200
Austin, Texas 78754-5140

Submitted by:

TRAC Laboratories, Inc.
14 South 2nd Street
Pensacola, Florida 32507
(850) 456-5836

Florida Department of Health and Rehabilitative Services
Certification Number E81181

Project: TNRCC TMDL
Subcontract Number: 740785.3002-00
Sampling Event Numbers: 7-10

June 2002

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Toxicity Test Summary Sheet

Client:	Parsons ES
Subcontract Num:	740785.3002-00
Study Director:	Dan Johnson
Test Material:	Whole sediment samples from Segment 2201 (Arroyo Colorado Tidal).
Date Materials Collected:	30 October 2001 through 8 April 2002
Date of Tests:	9 November 2001 through 29 April 2002
Test Conditions:	Static, 10 day duration.
Test Procedures:	1994. U.S. EPA. (EPA/600/R-94/025). Methods for Assessing the Toxicity of Sediment-associated Contaminants With Estuarine and Marine Amphipods. 1998. U.S. EPA. (EPA 823-B-98-004). Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual.
Test Organisms:	*Neanthes arenaceodentata* and *Leptocheirus plumulosus*
Source:	*N. arenaceodentata* were supplied by Dr. Don Reish, California State, Long Beach. *L. plumulosus* were supplied by Chesapeake Cultures.
Control and Dilution Water:	Synthetic sea water at a salinity of 30 parts per thousand (ppt) for *N. arenaceodentata* tests and 20 ppt for *L. plumulosus* tests.
Exposure Concentration:	100% sediment.
Effect Criteria:	Survival.

INTRODUCTION

Sediments samples tested in this study are part of the TNRCC TMDL study. This study represents testing of sampling events 7 through 10. Sediment samples from segment 2201 were received from Parsons personnel and tested at TRAC Laboratories Inc., Pensacola, Florida, to determine acute effects to *Neanthes arenaceodentata* and *Leptocheirus plumulosus*. The criterion for effect was survival. Tests were conducted from 9 November 2001 through 29 April 2002. All raw data related to this study are stored at TRAC. Data are presented as hard copy data files in Excel worksheet format.

MATERIALS AND METHODS

Test Material

Sediment samples were obtained from Parsons by TRAC personnel via Federal Express. The samples were contained in 1 gallon high density polyethylene jars.

A chain of custody form accompanied each sediment shipment. Sample label information was recorded in the sediment receiving log as was arrival temperature and the date received at TRAC Laboratories in Pensacola, Florida.

Sample identification, approximate volume, sieve size used for press-sieving, date of receipt and processing data were recorded in the sample log prior to test initiation.

Four samples were tested from segment 2201. Samples from segment 2201 (Arroyo Colorado Tidal) were labeled as: 13071, 13782, 13072 and 2201-Duplicate. Sampling and testing dates are included in Data files 2-5.

Control Water

Synthetic sea water made with 40 Fathoms® commercial marine salt mix and deionized water was adjusted to salinities of 30ppt for *N. arenaceodentata* exposures and 20ppt for *L. plumulosus* exposures. The salinity adjusted and conditioned water was then acclimated to the test temperature of 20°C. This water was then used for overlying water in the sediment exposures and positive control reference toxicant tests.

Test Animals

Neanthes arenaceodentata were obtained from Dr. Don Reish, California State University, Long Beach. The *N. arenaceodentata* were juveniles, 2-3 weeks in age.

Leptocheirus plumulosus were obtained from Chesapeake Cultures, Inc., Hayes, Virginia and were 2-4 mm in length.

Animals were shipped (via overnight courier) in their native sediment with overlying natural sea water. Upon arrival, temperature and salinity were noted, water was exchanged and renewed with fresh control water for acclimation to test conditions.

Test Conditions

Tests were conducted in a temperature-controlled (20 ± 2^0C) environmental chamber under a 24-hour light photo period. Daily animal observations were conducted and any dead organisms or molts were removed. Live *L. plumulosus* and *N. arenaceodentata* found floating during the test period were gently submerged with a pipet and allowed a 15 minute period for burrowing before replacing airlines. Each replicate was gently aerated (~100 bubbles/minute) throughout the 10-day test, and frequent daily checks insured airlines were aerating the water column.

Sediment Preparation

Sediment samples were press sieved through a 1.0 mm stainless steel sieve to remove particles and predators which might interfere with the testing process. The complete contents of each sample, including the sediment porewater, were captured and used to aid the sample in passing through the sieve.

Following the press sieving step and prior to test initiation, sediments were homogenized by blending the sediment 3 - 5 minutes with a stainless steel spoon or mechanical paddle.

Once homogenized, the sediments were measured out in 200 ml aliquots and transferred to randomly assigned one liter glass jars. Six replicates were measured out for each sediment sample. Five replicates were set up for the 10 day exposures and the sixth replicate was used to measure porewater ammonia.

Test Initiation

The randomly assigned jars containing exposure sediments were placed in the environmental chamber in numerical order. Seven hundred fifty ml of natural seawater diluted to 30ppt or 20ppt were carefully poured over a turbidity reducer to fill the test vessel. The exposure vessels were then allowed to settle 14-16 hours before test organisms were introduced.

After the settling period, physical parameters (pH, DO, temperature and salinity) were monitored and recorded on the physical data sheets prior to introduction of test organisms.

Once acclimated to laboratory conditions (Salinity, temperature and lighting), test organisms were removed from the native sediment and prepared for test sorting. *L. plumulosus* 2 - 4 mm in length were selected individually with a medium bore pipette and transferred to a 30 ml beaker containing prepared 20ppt seawater. Ten *L. plumulosus* were collected in each beaker and observed for good color, full gut, and size.

Two beakers of 10 animals were combined and added in random sequence to each exposure vessel, releasing 20 *L. plumulosus* into the sediment exposure. Two extra beakers with ten animals each were randomly selected for size measurements at test initiation and recorded on the day 0 setup sheet.

N. arenaceodentata were gently agitated with a pipet to remove them from tubes. Five worms were placed in a 30 ml beaker containing 10 ml of 30ppt seawater and then added in random sequence to each sediment replicate.

One hour after addition of test organisms, each sediment replicate was examined to ensure all animals were established in the sediment and air lines replaced.

Ammonia Analysis

The sixth replicate was brought into the environmental chamber with the 10-day sediment exposures and treated the same (aerated) as the other five replicates. A fritted glass sampler was placed approximately 2.0 cm into the sediment prior to addition of overlying water. Hydrostatic pressure forced interstitial water into the sampler after passing through a 1.0 μ pore glass fiber filter (Gelman Sciences, type A/E) which was wrapped around the fritted portion of the sampler to prevent clogging.

Ten to twenty ml of interstitial water were removed from the neck of the fritted sampler 16-20 hours into the test (day 0). Temperature, salinity and pH measurements were recorded prior to the total ammonia analysis. The Orion 250A pH/ISE meter and 95-12 gas-sensing ammonia electrode measured the ammonia ion after conversion to ammonia gas. Sample color and turbidity do not affect measurements by this method. Other ionic species do not interfere with this probe. The ammonia-selective electrode method (4500-NH_3, ASTM 13th Edition, 1992) was followed by raising each sample's pH to above 11 with 10 N NaOH, and measuring ammonia across the probe's membrane as it is converted from aqueous NH_3 and NH_4^+. Potentiometric measurements were recorded for each sample in millivolts (mV) and extrapolated to mg/L of total ammonia from a standard curve constructed with each test series.

A standard ammonia curve was constructed for each test series using four standards (0.1, 1.0, 10 and 100 mg/L) diluted from a 1000 mg/L stock of ammonia. The log transformed standard concentrations were entered into a linear regression with their potentiometric responses (mV) yielding correlations of 98 to 100%. All sample measurements were then entered into this same formula to retrieve a total ammonia measurement in mg/L.

In each test series, DI water blanks were measured to calibrate a zero-ammonia point for the probe. When enough sample was available, a sample was duplicated to measure variation. Total ammonia concentrations for each sample ID are presented as Data File 1.

Test Termination

Sediment tests were terminated after 10 days. Sediment vessels were removed in numerical order from the environmental chamber animal recovery. Sediments and overlying water were passed through a 250 micron mesh sieve which was designed to capture the test organisms while allowing some sediments to pass through. Because of time constraints due to the number of exposure replicates, all material retained in the sieve was preserved in a 70% ethanol solution with rose Bengal stain. Organisms were later recovered and counted from the preserved exposures and recorded on the breakdown sheet. Once all exposure replicates were broken down and picked, the data was grouped according to the sediment ID. The randomization sheet was used to unscramble the exposure vessel numbers which in turn accounted for the five replicates. The descrambling sheet provides sample ID matched to randomized vessel numbers.

Reference Toxicant (Positive Control)

A positive control "reference toxicant" test was conducted with each shipment of test organisms. The reference toxicant used was sodium dodecyl sulfate (SDS) and the test was conducted in accordance with EPA/600/4-90/027F and EPA/620/R-95/008. Values were plotted to determine if the results were within prescribed limits. In this technique, a running plot is maintained for the toxicity values from successive tests with a given reference toxicant. For regression analysis results (i.e. LC50s), the mean (x) and upper and lower control limits (±2SD) are recalculated with each successive point until the statistics stabilize. Control charts are presented as figures 1 and 2.

Reference Sediment (Negative Control)

All sediment tests were accompanied by a negative control reference sediment test. Replication of these control samples were the same as for the study site samples (five exposure replicates; one replicate for ammonia analysis). Negative control reference sediment (C-17) was obtained by TRAC personnel from Perdido Bay at position 30^0 19.753' N, 087^0 27.869' W. The principal reason for selecting C-17 as a suitable reference sediment is in the toxicological data base developed for *A. abdita* by USEPA's EMAP Louisianian Province in previous years (1990-1994).

Statistical Analysis

The sediment samples were tested in groups of four with a common negative control. ANOVA and Dunnett's multiple range tests were used to identify samples in which survival was statistically lower from the negative controls. The survival proportions were transformed using Arcsin ($\sqrt{p2_i}$) where p_i = proportion surviving in replicate I. The data was then examined for homogeneity of variance and departure from normality using Bartlett's and Shapiro-Wilks tests, respectively. If the data were normally distributed and the variances homogenous, the transformed data was analyzed with a one-way ANOVA. If the F test of the ANOVA was significant ($p<0.05$), differences between the mean of each sample were compared with the control using Dunnett's test. Dunnett's test is specifically intended to compare treatment means with a control. If the F test in the ANOVA is not significant, no further analysis is performed, and the sample means are then statistically similar to the control. When the assumptions of normality and variance homogeneity cannot be verified, Steel's Many One Rank Test is used to examine differences between the control and each mean. Steel's Test is specifically intended to examine differences between treatments and a control when assumptions of normality and variance homogeneity cannot be verified.

RESULTS AND DISCUSSION

Survival Information

Survival data was calculated for each replicate as percent survival; mean and standard deviation were calculated for each sample.

Statistical analysis was performed as defined above. Based on data analysis, no significant reductions in survival of either species were measured in any sample from segment 2201. Control (C17) survival throughout all four testing events was acceptable (≥90%). Complete survival data are displayed in Data Files 2-5.

Physical Parameters

Salinity, dissolved oxygen and pH were measured in each test replicate on days 0, 4, 7 and 10. Temperature was measured in each exposure replicate daily and were consistently 20°C ±2°C. Dissolved oxygen levels were maintained with gentle aeration throughout the ten day exposure and levels stayed above 60% of saturation.

Figure 1. ***Neanthes arenaceodentata*** **Acute Control Chart**

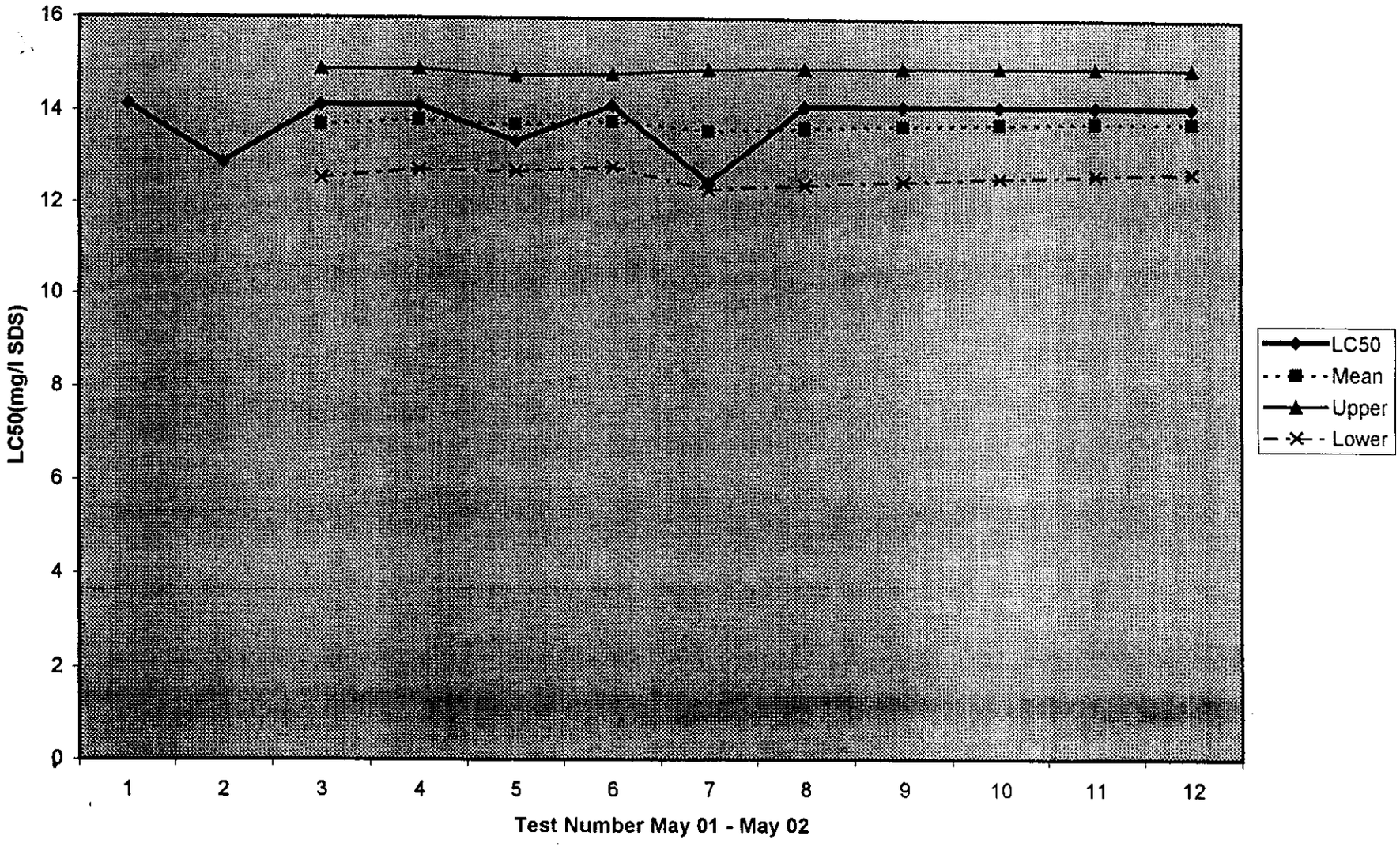
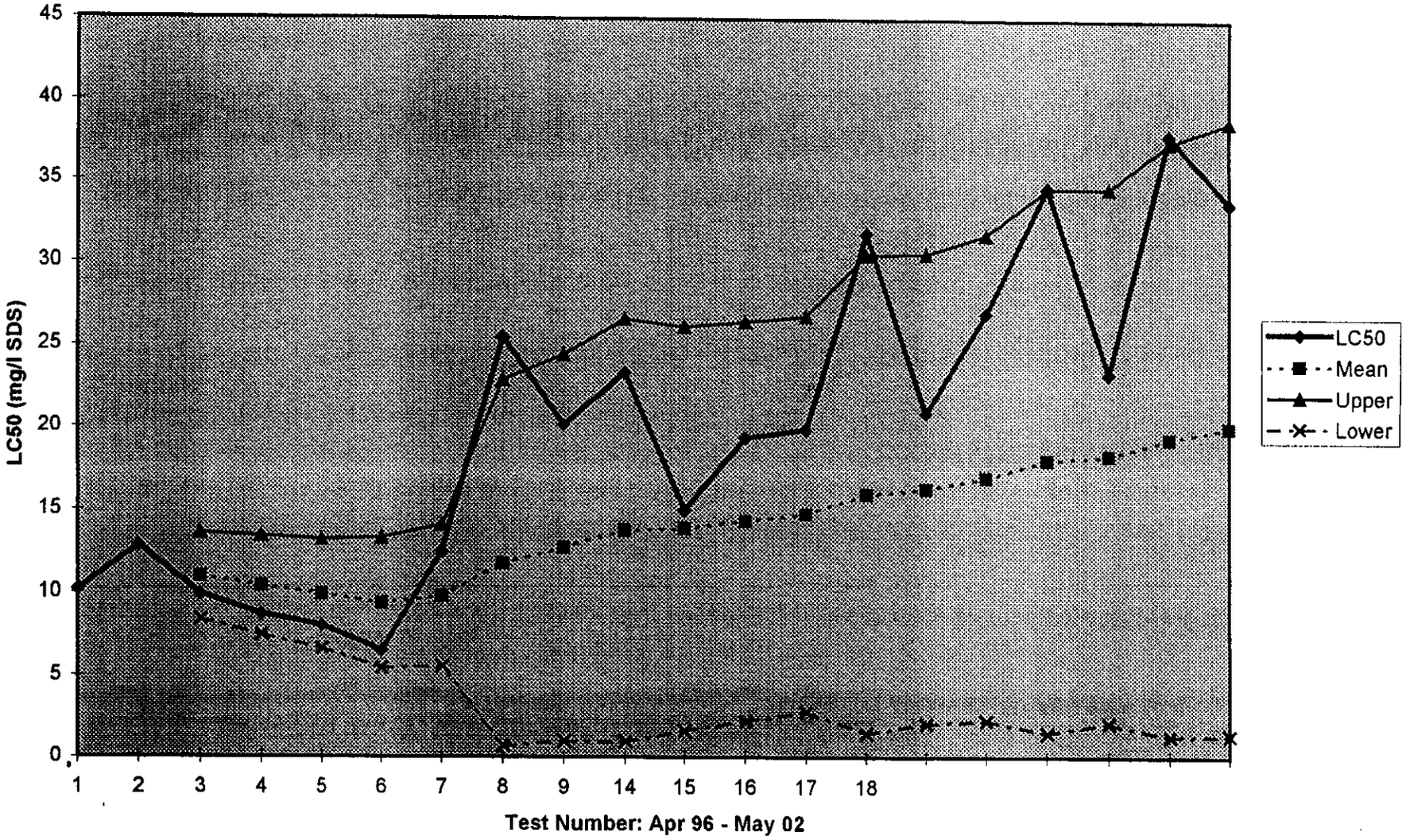


Figure 2. *Leptocheirus plumulosus* Acute Control Chart



DATA FILE 1

Total Ammonia
Measurements from Interstitial Water

Ammonia Analyses

Sample ID	Segment	Event	Total Ammonia (mg/L)	Temp (^{0}C)
13782-7	2201	7	0.47	20
13071-7	2201	7	0.89	20
13072-7	2201	7	0.26	20
2201-DUPL-7	2201	7	0.07	20
13782-8	2201	8	0.10	20
13071-8	2201	8	0.15	20
13072-8	2201	8	0.38	20
2201-DUPL-8	2201	8	0.10	20
13782-9	2201	9	0.02	20
13071-9	2201	9	0.02	20
13072-9	2201	9	0.01	20
2201-DUPL-9	2201	9	0.02	20
13782-10	2201	10	0.28	20
13071-10	2201	10	0.29	20
13072-10	2201	10	0.40	20
2201-DUPL-10	2201	10	0.22	20

DATA FILE 2

Summary of Sampling Event 7:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroy

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 9 - 19 November 2001

Samples Collected October 30, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference	CV (%)
C17 (Control)	20	100	98	4.47	0.05	N/A	4.6
	18	90					
	20	100					
	20	100					
	20	100					
13782-7	20	100	99	2.24	0.05	NO	2.3
	20	100					
	20	100					
	19	95					
	20	100					
13071-7	20	100	100	0.00	0.05	NO	0.0
	20	100					
	20	100					
	20	100					
	20	100					
13072-7	20	100	99	2.24	0.05	NO	2.3
	20	100					
	20	100					
	20	100					
	19	95					
2201-DUPL-7	20	100	100	0.00	0.05	NO	0.0
	20	100					
	20	100					
	20	100					
	20	100					

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 9 - 19 November 2001

Samples Collected October 30, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference	CV (%)
C17 (Control)	5	100	100	0.00	0.05	N/A	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13782-7	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13071-7	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13072-7	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
2201-DUPL-7	4	80	96	8.94	0.05	NO	9.3
	5	100					
	5	100					
	5	100					
	5	100					

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

DATA FILE 3

Summary of Sampling Event 8:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 18 - 28 January 2002

Samples Collected December 18, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference	CV (%)
C17 (Control)	19	95	97	4.47	0.05	N/A	4.6
	20	100					
	20	100					
	20	100					
	18	90					
13782-8	20	100	95	5.00	0.05	NO	5.3
	19	95					
	20	100					
	18	90					
	18	90					
13071-8	20	100	100	0.00	0.05	NO	0.0
	20	100					
	20	100					
	20	100					
	20	100					
13072-8	20	100	97	4.47	0.05	NO	4.6
	20	100					
	20	100					
	18	90					
	19	95					
2201-DUPL-8	19	95	93	2.74	0.05	NO	2.9
	18	90					
	18	90					
	19	95					
	19	95					

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 18 - 28 January 2002

Samples Collected December 18, 2001

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference	CV (%)
C17 (Control)	5	100	100	0.00	0.05	N/A	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13782-8	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13071-8	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13072-8	5	100	96	8.94	0.05	NO	9.3
	5	100					
	5	100					
	5	100					
	4	80					
2201-DUPL-8	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

DATA FILE 4

Summary of Sampling Event 9:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 8 - 18 March 2002

Samples Collected February 18, 2002

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference	CV (%)
C17 (Control)	19	95	99	2.24	0.05	N/A	2.3
	20	100					
	20	100					
	20	100					
	20	100					
13782-9	20	100	96	6.52	0.05	NO	6.8
	19	95					
	20	100					
	17	85					
	20	100					
13071-9	20	100	93	15.65	0.05	NO	16.8
	13	65					
	20	100					
	20	100					
	20	100					
13072-9	19	95	94	4.18	0.05	NO	4.5
	19	95					
	18	90					
	20	100					
	18	90					
2201-DUPL-9	20	100	100	0.00	0.05	NO	0.0
	20	100					
	20	100					
	20	100					
	20	100					

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 8 - 18 March 2002

Samples Collected February 18, 2002

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference	CV (%)
C17 (Control)	5	100	100	0.00	0.05	N/A	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13782-9	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13071-9	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13072-9	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
2201-DUPL-9	5	100	96	8.94	0.05	NO	9.3
	5	100					
	4	80					
	5	100					
	5	100					

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

DATA FILE 5

Summary of Sampling Event 10:
Sample Collection Dates, Test Dates and Survival Data

Segment 2201, Arroyo Colorado Tidal

Survival of *Leptocheirus plumulosus* in Ten-day Sediment Exposures Conducted 19 - 29 April 2002

Samples Collected April 8, 2002

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference	CV (%)
C17 (Control)	20	100	100	0.00	0.05	N/A	0.0
	20	100					
	20	100					
	20	100					
	20	100					
13782-10	20	100	99	2.24	0.05	NO	2.3
	20	100					
	20	100					
	19	95					
	20	100					
13071-10	20	100	99	2.24	0.05	NO	2.3
	20	100					
	19	95					
	20	100					
	20	100					
13072-10	19	95	99	2.24	0.05	NO	2.3
	20	100					
	20	100					
	20	100					
	20	100					
2201-DUPL-10	20	100	98	2.74	0.05	NO	2.8
	19	95					
	19	95					
	20	100					
	20	100					

Four stations total.

13071:'Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

Segment 2201, Arroyo Colorado Tidal

Survival of *Neanthes arenaceodentata* in Ten-day Sediment Exposures Conducted 19 - 29 April 2002

Samples Collected April 8, 2002

All statistical analyses were performed using TOXSTAT and followed USEPA guidelines for whole effluent toxicity tests

Sample ID	Number Surviving	Percent Survival	Mean % Survival	Standard Deviation	p Value	Statistical Difference	CV (%)
C17 (Control)	5	100	100	0.00	0.05	N/A	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13782-10	5	100	100	0.00	0.05	NO	0.0
	5	100					
	5	100					
	5	100					
	5	100					
13071-10	5	100	92	10.95	0.05	NO	11.9
	4	80					
	5	100					
	4	80					
	5	100					
13072-10	5	100	96	8.94	0.05	NO	9.3
	5	100					
	5	100					
	4	80					
	5	100					
2201-DUPL-10	4	80	96	8.94	0.05	NO	9.3
	5	100					
	5	100					
	5	100					
	5	100					

Four stations total.

13071: Arroyo Colorado Tidal at Mile 10 (Marker 22)

13782: Arroyo Colorado Tidal near Marker 16 at Arroyo City, Km 10.9

13072: Arroyo Colorado Tidal at fm 106 Bridge at Rio Hondo

2201-DUPL

APPENDIX D
CHEMICAL TESTS LABORATORY REPORTS AND DATA SUMMARY

Appendix D
Summary of Chemical Analysis
Arroyo Colorado Tidal Segment 2201

		Station ID 13782					
	PARAMETER	6/11/01 RESULT	8/10/01 RESULT	2/18/02 RESULT	Probable Effect Level (PEL)	85th Percentile	UNITS
Ions	Chloride	2140	2660	4990			mg/Kg-dry wt
	Sulfate	485	512	848			mg/Kg-dry wt
Metals	Aluminum	7880	4670	6940			mg/Kg-dry wt
	Arsenic	2.07	2.21	1.92	41.6	8.99	mg/Kg-dry wt
	Barium	120	56.2	63.1		244.0	mg/Kg-dry wt
	Cadmium	ND	ND	ND	4.21	0.75	mg/Kg-dry wt
	Calcium	24900	16600	21400			mg/Kg-dry wt
	Chromium	6.68	5.47	6.47	160.4	49.0	mg/Kg-dry wt
	Copper	3.61	3.28	3.65	18.7	37.2	mg/Kg-dry wt
	Iron	7750	6140	7610			mg/Kg-dry wt
	Lead	4.82	4.09	4.38	108.2	37.2	mg/Kg-dry wt
	Magnesium	2710	2130	2580			mg/Kg-dry wt
	Nickel	5.14	3.98	4.94	42.8	23.8	mg/Kg-dry wt
	Potassium	2390	1760	2310			mg/Kg-dry wt
	Selenium	ND	ND	ND		1.24	mg/Kg-dry wt
	Silver	ND	ND	ND	1.77	1.17	mg/Kg-dry wt
	Sodium	1670	2060	3030			mg/Kg-dry wt
	Zinc	20.3	16	19.9	124		mg/Kg-dry wt
	Mercury	ND	ND	ND	271.0	200.0	mg/Kg-dry wt
Volatiles	1,1,1-Trichloroethane	ND	ND	ND	30	300	µg/Kg-dry wt
	1,1,2,2-Tetrachloroethane	ND	ND	ND	940	300	µg/Kg-dry wt
	1,1,2-Trichloroethane	ND	ND	ND	1257	300	µg/Kg-dry wt
	1,1-Dichloroethane	ND	ND	ND	27	300	µg/Kg-dry wt
	1,1-Dichloroethene	ND	ND	ND	31	312.5	µg/Kg-dry wt
	1,2-Dibromoethane	ND	ND	ND		350	µg/Kg-dry wt
	1,2-Dichloroethane	ND	ND	ND	256	300	µg/Kg-dry wt
	1,2-Dichloropropane	ND	ND	ND	2075	300	µg/Kg-dry wt
	2-Chloroethyl vinyl ether	ND	ND	ND	9727	3000	µg/Kg-dry wt
	Benzene	ND	ND	ND	57	300	µg/Kg-dry wt
	Bromodichloromethane	ND	ND	ND	7426		µg/Kg-dry wt
	Bromoform	ND	ND	ND	650	300	µg/Kg-dry wt
	Bromomethane	ND	ND	ND	18	750	µg/Kg-dry wt
	Carbon disulfide	ND	ND	ND			µg/Kg-dry wt
	Carbon tetrachloride	ND	ND	ND	225	300	µg/Kg-dry wt
	Chlorobenzene	ND	ND	ND	413	312.5	µg/Kg-dry wt
	Chloroethane	ND	ND	ND	7937	750	µg/Kg-dry wt
	Chloroform	ND	ND	ND	22	300	µg/Kg-dry wt
	Chloromethane	ND	ND	ND	432	750	µg/Kg-dry wt
	cis-1,3-Dichloropropene	ND	ND	ND	0.05		µg/Kg-dry wt
	Dibromochloromethane	ND	ND	ND	8701	300	µg/Kg-dry wt
	Ethylbenzene	ND	ND	ND	10	340	µg/Kg-dry wt
	Hexachlorobutadiene	ND	ND	ND	11		µg/Kg-dry wt
	m,p-Xylene	ND	ND	ND			µg/Kg-dry wt
	Methyl tert-butyl ether	ND	ND	ND			µg/Kg-dry wt
	Methylene chloride	ND	ND	ND	374	315	µg/Kg-dry wt
	o-Xylene	ND	ND	ND			µg/Kg-dry wt
	Tetrachloroethene	ND	ND	ND			µg/Kg-dry wt
	Toluene	ND	ND	ND		312	µg/Kg-dry wt
	trans-1,2-Dichloroethene	ND	ND	ND			µg/Kg-dry wt
	trans-1,3-Dichloropropene	ND	ND	ND	230		µg/Kg-dry wt
	Trichloroethene	ND	ND	ND	215		µg/Kg-dry wt
	Vinyl chloride	ND	ND	ND	691	750	µg/Kg-dry wt
Semi-Vol.	1,2,4-Trichlorobenzene	ND	ND	ND		1399.5	µg/Kg-dry wt
	1,2-Dichlorobenzene	ND	ND	ND	50	1399	µg/Kg-dry wt
	1,3-Dichlorobenzene	ND	ND	ND	1664	1530	µg/Kg-dry wt
	1,4-Dichlorobenzene	ND	ND	ND	110	1389.5	µg/Kg-dry wt
	2,4,5-Trichlorophenol	ND	ND	ND		2050	µg/Kg-dry wt
	2,4,6-Trichlorophenol	ND	ND	ND		1950	µg/Kg-dry wt
	2,4-Dichlorophenol	ND	ND	ND		1950	µg/Kg-dry wt
	2,4-Dimethylphenol	ND	ND	ND		1950	µg/Kg-dry wt
	2,4-Dinitrophenol	ND	ND	ND		6650	µg/Kg-dry wt
	2,4-Dinitrotoluene	ND	ND	ND	293	1800	µg/Kg-dry wt
	2,6-Dinitrotoluene	ND	ND	ND	10341	1709	µg/Kg-dry wt
	2-Chloronaphthalene	ND	ND	ND	267345	1970.45	µg/Kg-dry wt
	2-Chlorophenol	ND	ND	ND		1950	µg/Kg-dry wt
	2-Methylnaphthalene	ND	ND	ND	20.2		µg/Kg-dry wt

Appendix D
Summary of Chemical Analysis
Arroyo Colorado Tidal Segment 2201

		Station ID 13782					
	PARAMETER	6/11/01 RESULT	8/10/01 RESULT	2/18/02 RESULT	Probable Effect Level (PEL)	85th Percentile	UNITS
	2-Methylphenol	ND	ND	ND			µg/Kg-dry wt
	2-Nitrophenol	ND	ND	ND		1950	µg/Kg-dry wt
	3,3'-Dichlorobenzidine	ND	ND	ND	20603	2900	µg/Kg-dry wt
	4,6-Dinitro-2-methylphenol	ND	ND	ND			µg/Kg-dry wt
	4-Bromophenyl phenyl ether	ND	ND	ND	1248	1800	µg/Kg-dry wt
	4-Chloro-3-methylphenol	ND	ND	ND			µg/Kg-dry wt
	4-Chlorophenyl phenyl ether	ND	ND	ND	456209	1800	µg/Kg-dry wt
	4-Methylphenol	ND	ND	ND			µg/Kg-dry wt
	4-Nitrophenol	ND	ND	ND		6650	µg/Kg-dry wt
	Acenaphthene	ND	ND	ND	6.71	1709	µg/Kg-dry wt
	Acenaphthylene	ND	ND	ND	5.87	1709	µg/Kg-dry wt
	Anthracene	ND	ND	ND	46.85	4600	µg/Kg-dry wt
	Benzo(a)anthracene	ND	ND	ND	74.8	1800	µg/Kg-dry wt
	Benzo(a)pyrene	ND	ND	ND	88.8	1800	µg/Kg-dry wt
	Benzo(b)fluoranthene	ND	ND	ND	27372	1800	µg/Kg-dry wt
	Benzo(g,h,I)perylene	ND	ND	ND	720	1800	µg/Kg-dry wt
	Benzo(k)fluoranthene	ND	ND	ND	3600	1800	µg/Kg-dry wt
	Bis(2-chloroethoxy)methane	ND	ND	ND		1709	µg/Kg-dry wt
	Bis(2-chloroethyl)ether	ND	ND	ND	368	1709	µg/Kg-dry wt
	Bis(2-chloroisopropyl)ether	ND	ND	ND		1709	µg/Kg-dry wt
	Bis(2-ethylhexyl)phthalate	ND	ND	ND	182		µg/Kg-dry wt
	Butyl benzyl phthalate	ND	ND	ND	900		µg/Kg-dry wt
	Chrysene	ND	ND	ND	108	1800	µg/Kg-dry wt
	Di-n-butyl phthalate	ND	ND	ND	11000	2800	µg/Kg-dry wt
	Di-n-octylphthalate	ND	ND	ND	885363	1800	µg/Kg-dry wt
	Dibenzo(a,h)anthracene	ND	ND	ND	6.22	1800	µg/Kg-dry wt
	Diethyl phthalate	ND	ND	ND	200	1800	µg/Kg-dry wt
	Dimethyl phthalate	ND	ND	ND		1709	µg/Kg-dry wt
	Fluoranthene	ND	ND	ND	113	2176.9	µg/Kg-dry wt
	Fluorene	ND	ND	ND	19	1800	µg/Kg-dry wt
	Hexachlorobenzene	ND	ND	ND	22		µg/Kg-dry wt
	Hexachlorocyclopentadiene	ND	ND	ND		1920	µg/Kg-dry wt
	Hexachloroethane	ND	ND	ND	1000	1709	µg/Kg-dry wt
	Indeno[1,2,3-cd]pyrene	ND	ND	ND		1800	µg/Kg-dry wt
	Isophorone	ND	ND	ND		1709	µg/Kg-dry wt
	N-Nitrosodi-n-propylamine	ND	ND	ND		1709	µg/Kg-dry wt
	N-Nitrosodiphenylamine	ND	ND	ND		1350	µg/Kg-dry wt
	Naphthalene	ND	ND	ND	34.6	1399.5	µg/Kg-dry wt
	Nitrobenzene	ND	ND	ND		1709	µg/Kg-dry wt
	Pentachlorophenol	ND	ND	ND		3850	µg/Kg-dry wt
	Phenanthrene	ND	ND	ND	86.7	1800	µg/Kg-dry wt
	Phenol	ND	ND	ND		1950	µg/Kg-dry wt
	Pyrene	ND	ND	ND	153	2100	µg/Kg-dry wt
Trianzines	Atrazine	ND	ND	ND			µg/Kg-dry wt
	Cyanazine	ND	ND	ND			µg/Kg-dry wt
	Metolachlor	ND	ND	ND			µg/Kg-dry wt
	Simazine	ND	ND	ND			µg/Kg-dry wt
Pest/PCBs	a-BHC	ND	ND	ND		16.4	µg/Kg-dry wt
	Alachlor	ND	ND	ND			µg/Kg-dry wt
	Aldrin	ND	ND	ND		21	µg/Kg-dry wt
	b-BHC	ND	ND	ND		30	µg/Kg-dry wt
	Chlordane	ND	ND	ND	8.9	190	µg/Kg-dry wt
	d-BHC	ND	ND	ND		30	µg/Kg-dry wt
	4,4'-DDD	ND	ND	ND		65	µg/Kg-dry wt
	4,4'-DDE	ND	ND	ND		30	µg/Kg-dry wt
	4,4'-DDT	ND	ND	ND	51.7	37	µg/Kg-dry wt
	Dicofol	ND	ND	ND		31	µg/Kg-dry wt
	Dieldrin	ND	ND	ND	6.67	15	µg/Kg-dry wt
	Endosulfan	ND	ND	ND			µg/Kg-dry wt
	Endosulfan sulfate	ND	ND	ND		48	µg/Kg-dry wt
	Endrin	ND	ND	ND		28.65	µg/Kg-dry wt
	g-BHC (Lindane)	ND	ND	ND	0.99	16.4	µg/Kg-dry wt
	Heptachlor	ND	ND	ND		17.5	µg/Kg-dry wt
	Heptachlor epoxide	ND	ND	ND	0.6	50.0	µg/Kg-dry wt
	Methoxychlor	ND	ND	ND		75	µg/Kg-dry wt
	Mirex	ND	ND	ND		25	µg/Kg-dry wt

Appendix D
Summary of Chemical Analysis
Arroyo Colorado Tidal Segment 2201

		Station ID 13782					
	PARAMETER	6/11/01 RESULT	8/10/01 RESULT	2/18/02 RESULT	Probable Effect Level (PEL)	85th Percentile	UNITS
	PCB-1016	ND	ND	ND		350	µg/Kg-dry wt
	PCB-1221	ND	ND	ND		350	µg/Kg-dry wt
	PCB-1232	ND	ND	ND		350	µg/Kg-dry wt
	PCB-1242	ND	ND	ND		350	µg/Kg-dry wt
	PCB-1248	ND	ND	ND		1000	µg/Kg-dry wt
	PCB-1254	ND	ND	ND		1000	µg/Kg-dry wt
	PCB-1260	ND	ND	ND		1000	µg/Kg-dry wt
	Toxaphene	ND	ND	ND		550	µg/Kg-dry wt
Organo-phosphorus Compounds	Chloropyrifos	ND	ND	ND		78	µg/Kg-dry wt
	Demeton (Total)	ND	ND	ND		100	µg/Kg-dry wt
	Diazinon	ND	ND	ND		77.65	µg/Kg-dry wt
	Guthion	ND	ND	ND		87.15	µg/Kg-dry wt
	Malathion	ND	ND	ND		77.65	µg/Kg-dry wt
	Parathion	ND	ND	ND		72	µg/Kg-dry wt
Chlorinated Herbicides	2,4,5-T	ND	ND	ND		13	µg/Kg-dry wt
	2,4,5-TP (Silvex)	ND	ND	ND		11	µg/Kg-dry wt
	2,4-D	ND	ND	ND		75	µg/Kg-dry wt
Carbamates	Carbaryl	ND	ND	ND			µg/Kg-dry wt
	Diuron	ND	ND	ND			µg/Kg-dry wt
SEM	Cadmium	0.03 J	ND	ND			µmol/dry g
	Copper	0.89	1.2	0.12			µmol/dry g
	Lead	2.21	2.1	0.026			µmol/dry g
	Mercury	0.0003 J	ND	ND			µmol/dry g
	Nickel	0.87	1.5	0.037			µmol/dry g
	Silver	0.522	ND	NA			µmol/dry g
	Zinc	15.5 U	1.3	0.46			µmol/dry g
	Total Organic Carbon (TOC)	1800	3986	1900			mg/Kg
	Acid Volatile Sulfide (AVS)	138	ND	0.24			µmol/dry g
Grain Size	Sand	84.05	86.6	44.0			%
	Silt	8.55	7.70	40.5			%
	Clay	7.4	5.70	15.1			%

Notes:

* Criteria is from Table 20 Sediment Screening Levels, in *TNRCC Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, 2002, October 16, 2002, Screening Level* tables. The value is the PEL Marine and Tidal Stream 85th Percentile value from the

J- result is estimated

ND- result was Not Detected

mg/kg-dry = milligrams per kilogram dry weight

ug/kg-dry = microgram per kilogram dry weight

umol/dry g = microgram per mole per dry gram

% = percent

APPENDIX E
DATA QUALITY OBJECTIVES AND VALIDATION REPORTS

Appendix E Data Quality Objectives for Measurement Data

Parameter	Units	Method Type	Method	Method Description	Storet	MAL	Precision of Laboratory Duplicates (RPD)	Accuracy of Matrix Spikes % Recovery	Accuracy crm	Percent Complete
Field Parameters										
pH	pH units	YSI Multi-Parameter Probe	EPA 150.1 or TCEQ SOP	probe	00400	1.0	10	NA	+/- 0.1	90
Dissolved Oxygen (DO)	mg/L	YSI Multi-Parameter Probe	EPA 360.1 or TCEQ SOP	probe	00300	1.0	10	+/- 0.5	NA	90
Conductivity	uS/cm	YSI Multi-Parameter Probe	EPA 120.1 or TCEQ SOP	probe	00094	1	10	+/- 5	+/- 5	90
Temperature	° Celcius	YSI Multi-Parameter Probe	EPA 170.1 or TCEQ SOP	probe	00010	NA	10	NA	NA	90
Salinity	ppt	YSI Multi-Parameter Probe	TCEQ SOP	probe	00480	NA	NA	NA	NA	90
Instantaneous Stream Flow	cfs	Flowmeter	TCEQ SOP	sensor	00061	NA	NA	NA	NA	90
Flow Severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	Observation	TCEQ SOP	Field observation	01351	NA	NA	NA	NA	90
Conventional Parameters										
Total Residual Chlorine	mg/L	DPD	EPA 330.5	colorimetric	50060	0.1	20%	NA	NA	90
Sediment Grain-size	% particle size	Frac. Separation & gravi.metric determination	EPA 3.4, 3.5 (600/2-78-054)	Separation and gravimetric	89991, 82009, 82008, 80256	NA	NA	NA	NA	90
Total Suspended Solids	mg/L	gravimetric	EPA 160.2	gravimetric	00530	4.0	20	NA	+/- 10%	90
Total Organic Carbon (TOC)	mg/L	oxidation	EPA 415.1	oxidation	00680	1.0	20	78-120	+/- 10%	90
Total Organic Carbon (TOC) in sediment	mg/kg	Combustion	B&B Laboratories SOP 1005 See Appendix I	Combustion	81951	0.3	15	80-120	+/- 5%	90
Oil & Grease	mg/L	Extraction Gravimetry	EPA 413.1	Freon Extractable Material	00556	1.0	20	80-120	+/-10%	90
Dissolved Organic Carbon (DOC)	mg/L	oxidation	EPA 415.2	oxidation	00681	0.1	20	78-120	+/- 10%	90
Total Alkalinity, as $CaCO_3$	mg/L	potentiometric	EPA 310.1-.2	potentiometric	00410	3.0	20	78-120	NA	90
Total Dissolved Solids (TDS)	mg/L	residue gravimetric	EPA 160.1	residue gravimetric	70300	10.0	20	NA	NA	90
Sulfate in water	mg/L	ion chromatophgry	EPA 300.0/9056	IC	00945	3	20	70-113	+/- 10%	90
Sulfate in sediment	mg/kg	ion chromatophgry	EPA 300.0/9056	IC	85818	10	30	80-120	80-120	90
Sulfide in water	mg/L	colorimetric	EPA 371.2	colorimetric	00745	1.0	20	80-120	+/-10%	90
Flouride in water	mg/L	colorimetric	EPA 340.3/9056	Colorimetric/ IC	00950	0.5	20	80-120	+/-10%	90

Appendix E Data Quality Objectives for Measurement Data

Parameter	Units	Method Type	Method	Method Description	Storet	MAL	Precision of Laboratory Duplicates (RPD)	Accuracy of Matrix Spikes % Recovery	Accuracy crm	Percent Complete
Chloride in water	mg/L	colorimetric	EPA 325.2/9256	Colorimetric automated ferricyanide/IC	00940	1.0	20	80-120		90
Chloride in sediment	mg/kg	IC	EPA 300.0	IC	00943	10	30	80-120	80-120	90
Ammonia-N	mg/L	colorimetric	EPA 350.1	colorimetric	00610	0.02	20	68-135	NA	90
o-Phosphorus	mg/L	colorimetric, absorbic acid	EPA 365.3	IC	00671	0.01	20	80-120	NA	90
Potassium, total recoverable in water	mg/L	ICP/AES	EPA 200.7	ICP/AES	00937	0.05	20	80-149	90-110	90
Potassium in sediment	mg/kg	ICP/MS	EPA 6020	ICP/MS	00938	25	25	NA	80-120	90
Sodium, total recoverable in water	mg/L	ICP/AES	EPA 200.7	ICP/AES	00929	0.2	20	79-137	90-110	90
Sodium in sediment	mg/kg	ICP/MS	EPA 6020	ICP/MS	00934	25	25	NA	80-120	90
Nitrate/nitrite-N	mg/L	ion chromatography	EPA 353.2	Colorimetric automated cadmium reduction	00630	0.01	20	83-125	+/- 10%	90
Total Kjeldahl Nitrogen	mg/L	colorimetric, automated phenate	EPA 351.2	colorimetric	00625	0.1	20	72-133	+/- 10%	90
Total Phosphorus (TPO_4)	mg/L	colorimetric, automated, block digestor	365.1-4	colorimetric	00665	0.02	20	74-118	+/- 10%	90
Cyanide	mg/L	spectrophoto-metric	EPA 335.2	spectrophotometric	00720	5	20	80-120	+/-10%	90
Turbidity	NTU	nephelometric	EPA 180.1	nephelometric	82079	0.05	20	NA	+/-10%	90
Carbonaceous Biochemical Oxygen Demand (BOD)	mg/L	potentiometric	EPA 405.1	potentiometric	00307	1.0	25	NA	+/- 5%	90
Chemical Oxygen Demand (COD)	mg/L	colorimetric	EPA 410.1-3	colorimetric	00335 or 00340	10	25	NA	+/- 5%	90
Acid volatile sulfide in sediment	umol/g	colorimetry	EPA Draft 1991	Purge and trap, colorimetry	50088	0.5	40	60-130	NA	90
SEM Simultaneous extraction, sum of concentrations: Cd, Cu, Pb, Hg, Ni, Ag, and Zn	umol/g	CVAAS Hg, ICP Other elements	EPA 200.7/245.5	Purge and Trap, Atomic spectroscopy	50087	0.05-0.5 varies w/ metal	40	NA	NA	90
Metals, trace metals, and related parameters										
Aluminum, dissolved in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01106	10	25	80-120	80-120	90
Aluminum, total in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01105	10	25	80-120	80-120	90
Aluminum in sediment	mg/kg	Primary Direct	EPA 200.8 or 6010B/6020	ICP-MS	01108	12.5	25	NA	80-120	90
Arsenic, dissolved in water	µg/L	HGAFS	EPA 200.8	HGAF	01000	10	25	55-146	55-146	90
Arsenic, total in water	µg/L	HGAFS	EPA 1632	HGAF	01002	0.5	25	55-146	55-146	90
Arsenic in sediment	mg/kg	Primary Direct	EPA 6020/200.8	ICP-MS	01003	2.5	25	80-120	80-120	90
Barium, dissolved in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01005	10	25	80-120	80-120	90

Appendix E Data Quality Objectives for Measurement Data

Parameter	Units	Method Type	Method	Method Description	Storet	MAL	Precision of Laboratory Duplicates (RPD)	Accuracy of Matrix Spikes % Recovery	Accuracy crm	Percent Complete
Barium in sediment	mg/kg	Primary Direct	EPA 6020/200.8	ICP-MS	01008	2.5	25	80-120	80-120	90
Cadmium, dissolved in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01025	0.1	25	80-120	80-120	90
		Alternate Direct	EPA 200.9	GFAAS	01025	0.05	25	64-145	64-145	90
Cadmium, total in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01027	0.1	25	84-113	84-113	90
		Alternate Direct	EPA 200.9	GFAAS	01027	0.05	25	64-145	64-145	90
Cadmium in sediment	mg/kg	Primary Direct	EPA 200.8 or 6010B/6020	ICP-MS	01028	0.2	25	80-120	80-120	90
Calcium, dissolved in water	mg/L	ICP/AES	EPA 200.7	ICP-AES	00915	0.05	20	84-113	84-113	90
		Alternate Direct	EPA 215.1	Flame AAS	00915	0.03	20	80-120	80-120	90
Calcium, total recoverable in water	mg/L	ICP/AES	EPA 200.7	ICP-AES	00916	0.05	20	84-113	84-113	90
Calcium in sediment	mg/kg	Primary Direct	EPA 200.8 or 6010B/6020	ICP-MS	00917	12.5	25	80-120	80-120	90
Chromium, dissolved in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01030	2.0	25	80-120	80-120	90
Chromium, total in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01034	2.0	25	80-120	80-120	90
Chromium (hexavalent), total in water	µg/L	Ion Chromatography	EPA 1636	IC	01032	5.0	20	79-122	79-122	90
Chromium in sediment	mg/kg	Primary Direct	EPA 6020/200.8	ICP-MS	01029	2	25	80-120	80-120	90
Copper, dissolved in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01040	0.2	25	51-145	51-145	90
Copper, total in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01042	0.2	25	51-145	51-145	90
Copper in sediment	mg/kg	Primary Direct	EPA 6020/200.8	ICP-MS	01043	2.5	25	80-120	80-120	90
Hardness, total in water	mg/L	Primary Direct	EPA 130.1-.2	Titrametric EDTA	00900	1.0, as $CaCO_3$	20	80-120	80-120	90
Iron, total recoverable in water	µg/L	ICP-AES	EPA 200.7	ICP-AES	01045	0.05				90
Iron in sediment	mg/kg	ICP/MS	EPA 6020A	ICP/MS	01170	12.5				90
Lead, dissolved in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01049	0.05	25	72-143	72-143	90
Lead, total in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01051	0.05	25	72-143	72-143	90
Lead, in sediment	mg/kg	Primary Direct	EPA 200.8 or 6010B/6020	ICP-MS	01052	2	25	80-120	80-120	90
Magnesium, dissolved in water	mg/L	ICP/AES	EPA 200.7	ICP-AES	00925	0.05	20	80-120	80-120	90
		Alternate Direct	EPA 242.1	Flame AAS	00925	0.003	20	80-120	80-120	90
Magnesium, total recoverable in water	mg/L	ICP/AES	EPA 200.7	ICP-AES	00927	0.05	20	80-120	80-120	90
Magnesium in sediment	mg/kg	ICP/MS	EPA 6020	ICP/MS	00924	25	25	NA	80-120	90
Mercury, dissolved in water	µg/L	Primary Direct	EPA 1631	P/T CVAF	71890	0.0005	25	71-125	71-125	90
Mercury, total recoverable in water	µg/L	P/T CVAFS	EPA 1631	P/T CVAF	71900	0.0005	25	71-125	71-125	90
Mercury in sediment	mg/kg	Primary Direct	EPA 245.5	CVAAS	71921	0.05	25	80-120	80-120	90

Appendix E Data Quality Objectives for Measurement Data

Nickel, dissolved in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01065	1.0	20	68-134	68-134	90
		Alternate Direct	EPA 200.9	GFAAS	01065	2.0	25	65-145	65-145	90
Nickel, total in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01067	1.0	20	68-134	68-134	90
		Alternate Direct	EPA 200.9	GFAAS	01067	2.0	25	65-145	65-145	90
Nickel in sediment	mg/kg	Primary Direct	EPA 6020/200.8	ICP-MS	01068	2.5	20	80-120	80-120	90
Selenium, dissolved in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01145	1 or 2	25	59-149	59-149	90
		Alternate Direct	EPA 200.9	GFAAS	01145	2	25	56-131	56-131	90
Selenium, total recoverable in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01147	2	25	59-149	59-149	90
		Alternate Direct	EPA 200.9	GFAAS	01147	2	25	56-131	56-131	90
Selenium in sediment	mg/kg	Primary Direct	EPA 6010B/6020/200.8	ICP-MS	01148	5	25	80-120	80-120	90
Silver, dissolved in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01075	0.1	25	74-119	74-119	90
Silver, total in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01077	0.1	25	74-119	74-119	90
Silver in sediment	mg/kg	Primary Direct	EPA 6020/200.8	ICP-MS	01078	1	25	75-125	75-125	90
Zinc, dissolved in water	µg/L	ICP-MS	EPA 200.8	ICP-MS	01090	0.5	25	46-146	46-146	90
		Alternate Direct	EPA 200.7	ICP-AES	01090	5.0	25	67-142	67-142	90
		Alternate Direct	EPA 200.9	GFAAS	01090	0.5	25	67-142	67-142	90
Zinc, total in water	µg/L	Primary Direct	EPA 200.8	ICP-MS	01092	0.5	25	46-146	46-146	90
		Alternate Direct	EPA 200.7	ICP-MS	01092	5.0	25	80-120	80-120	90
		Alternate Direct	EPA 200.9	GFAAS	01092	0.5	25	67-142	67-142	90
Zinc, in sediment	mg/kg	Primary Direct	EPA 6020/200.8	ICP-MS	01093	2.5	25	80-120	80-120	90
Organic and Organometal Compounds										
Acenaphthene in water	µg/L	Primary	EPA 8270C	GC/MS	34205	4	30	49-125	49-125	90
Acenaphthene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34208	133	30	47-145	47-145	90
Anthracene in water	µg/L	Primary	EPA 8270C	GC/MS	34220	4	30	45-165	45-165	90
Anthracene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34223	660	30	27-133	27-133	90
Acenapthylene in water	µg/L	Primary	EPA 8270C	GC/MS	34200	4	30	47-125	47-125	90
Acenapthylene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34203	660	30	33-145	33-145	90
Acrolein in sediment (Propenal)	µg/kg	Primary	EPA8260B	GC/MS	34213	51	40	25-175	25-175	90
Acrylonitrile in water	µg/L	Primary	EPA8260B	GC/MS	34215	50	20	50-150	50-150	90
Acrylonitrile in sediment	µg/kg	Primary	EPA8260B	GC/MS	34218	3.71	40	25-175	25-175	90

Appendix E Data Quality Objectives for Measurement Data

Alachlor in water	µg/L	Primary	EPA 8081	GC/ECD	77825	0.10	25	50-150	50-150	90
		Alternate	EPA 525.1	L/S Extraction + Capillary GC/MS	77825	0.3	25			90
		Alternate	EPA 645	GC		0.6	25			90
		Alternate	EPA 1656	GC/ECD		0.06	25	23-101		90
Alachlor in sediment	µg/kg	Primary	EPA 8081	GC/ECD	75050	100	30	50-150	50-150	90
Aldrin in water	µg/L	Primary	EPA 8081	GC/ECD	39330	0.05	25	20-100	20-100	90
Aldrin in sediment	µg/kg	Primary	EPA 8081	GC/NPD	39333	50	30	50-150	50-150	90
Atrazine in water	µg/L	Primary	EPA 619	GC	39630	0.15	25	62-191	62-191	90
		Alternate	EPA 525.1	L/S Extraction + Capillary GC/MS		0.42	25			90
		Alternate	EPA 1656	GC/ECD		1.5	25	31-132		90
Atrazine in sediment	µg/kg	Primary	EPA 8141	GC/NPD	39631	50	30			90
Benzene in water	µg/L	Primary	EPA 8260B	GC/MS	34030	1	20	75-125	75-125	90
Benzene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34237	10	40	25-165	25-165	90
Bromoform in water	µg/L	Primary	EPA 8260B	GC/MS	32104	1	20	75-125	75-125	90
Bromoform in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34290	10	40	30-180	30-180	90
Bromomethane in water	µg/L	Primary	EPA 8260B	GC/MS	30202	1	20	62-147	62-147	90
Bromomethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	88802	5	30	70-130	70-130	90
Benz (a) Anthracene in water	µg/L	Primary	EPA 8270C	GC/MS	34526	4	30	51-133	51-133	90
Benz (a) Anthracene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34529	660	30	33-143	33-143	90
Benzo (a) Pyrene in water	µg/L	Primary	EPA 8270C	GC/MS	34247	4	30	41-125	41-125	90
Benzo (a) Pyrene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34250	660	30	17-163	17-163	90
Benzo (b) fluoranthene in water	µg/L	Primary	EPA 8270C	GC/MS	34230	4	30	37-125	37-152	90
Benzo (b) fluoranthene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34233	133	30	24-159	24-159	90
Benzo (ghi) Perylene in water	µg/L	Primary	EPA 8270C	GC/MS	34521	4	30	34-149	34-149	90
Benzo (ghi) Perylene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34524	660	30	15-219	15-219	90
Benzo (k) Fluoranthene in water	µg/L	Primary	EPA 8270C	GC/MS	34242	4	30	34-149	34-149	90
Benzo (k) Fluoranthene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34245	660	30	11-162	11-162	90
BHC, alpha in water	µg/L	Primary	EPA 8081	GC/ECD	39337	0.05	25	35-117	35-117	90
BHC, alpha in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39076	50	30	38-137	38-137	90
BHC, beta in water	µg/L	Primary	EPA 8081	GC/ECD	39338	0.05	25	51-121	51-121	90
BHC, beta in sediment	µg/kg	Primary	EPA 8081	GC/ECD	34257	50	30	51-133	51-133	90
BHC, delta in water	µg/L	Primary	EPA 8081	GC/ECD	34259	0.05	25	32-121	32-121	90
BHC, delta in sediment	µg/kg	Primary	EPA 8081	GC/ECD	34262	50	30	43-131	43-131	90
BHC, gamma (Lindane) in water	µg/L	Primary	EPA 8081	GC/ECD	39782	0.05	25	41-114	41-114	90
BHC, gamma (Lindane) in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39783	50	30	47-132	47-132	90
Bis (2-Chloroethoxy) Methane in water	µg/L	Primary	EPA 8270C	GC/MS	34278	4	30	49-125	49-125	90
Bis (2-Chloroethoxy) Methane in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34281	660	30	33-184	33-184	90
Bis (2-Chloroethyl) Ether in water	µg/L	Primary	EPA 8270C	GC/MS	34273	4	30	44-125	44-125	90
Bis (2-Chloroethyl) Ether in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34276	133	30	12-158	12-158	90
Bis (2-Chloroisopropyl) Ether in water	µg/L	Primary	EPA 8270C	GC/MS	34283	4	30	36-166	36-166	90

Appendix E Data Quality Objectives for Measurement Data

Bis (2-Chloroisopropyl) Ether in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34286	133	30	36-166	36-166	90
Bis (2-Ethylhexyl) Phthalate in water	µg/L	Primary	EPA 8270C	GC/MS	39100	4	30	33-129	33-129	90
Bis (2-Ethylhexyl) Phthalate in sediment	µg/kg	Primary	EPA 8270C	GC/MS	39102	660	30	8-158	8-158	90
4-Bromophenyl Phenyl Ether in water	µg/L	Primary	EPA 8270C	GC/MS	34636	4	30	53-127	53-127	90
4-Bromophenyl Phenyl Ether in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34639	660	30	53-130	53-130	90
N-Butylbenzyl Phthalate in water	µg/L	Primary	EPA 8270C	GC/MS	34292	10	30	26-125	26-125	90
N-Butylbenzyl Phthalate in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34295	660	30	15-152	15-152	90
Carbaryl (Sevin) in water	µg/L	Primary	EPA 8321	HPLC/MS	39750	1	25	40-131	40-131	90
Carbaryl (Sevin) in sediment	µg/kg	Primary	EPA 8321	HPLC/MS	81818	20	25	34-129	34-129	90
Carbon disulfide in water	µg/L	Primary	EPA 8260B	GC/MS	77041	25	20	50-150	50-150	90
		Alternate	EPA 1624	Isotope Dilution GC/MS	77041	25				90
Carbon disulfide in sediment	µg/kg	Primary	EPA 8260B	GC/MS	78544	50	30	50-150	50-150	90
		Alternate	EPA 1624	Isotope Dilution GC/MS	78544		25			90
Carbon Tetrachloride in water	µg/L	Primary	EPA 8260B	GC/MS	32102	1	20	62-125	62-152	90
Carbon Tetrachloride in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34299	10	40	60-150	60-150	90
Chlorobenzene in water	µg/L	Primary	EPA 8260B	GC/MS	34301	1	20	75-125	75-125	90
Chlorobenzene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34304	10	40	20-175	20-175	90
Chlorodibromomethane in water	µg/L	Primary	EPA 8260B	GC/MS	32105	1	20	73-125	73-125	90
Chlorodibromomethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34309	5	40	40-160	40-160	90
Chloroethane in water	µg/L	Primary	EPA 8260B	GC/MS	34311	1	50	53-145	53-145	90
Chloroethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34314	5	40	15-255	15-255	90
2-Chloroethylvinyl ether in water	µg/L	Primary	EPA 8260B	GC/MS	34576	50	20	50-150	50-150	90
2-Chloroethylvinyl ether in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34579	60	40	15-300	15-300	90
Chloroform in water	µg/L	Primary	EPA 8260B	GC/MS	32106	1	20	74-125	74-125	90
Chloroform in sediment	µg/L	Primary	EPA 8260B	GC/MS	34318	10	40	40-150	40-150	90
Chlordane in water	µg/L	Primary	EPA 8081	GC/ECD	39350	0.05	25	45-122	45-122	90
		Alternate	EPA 1656	GC/ECD	39350	1-2	25	69-133		90
		Alternate	EPA 525.1	L/S Extraction + Capillary GC/MS	39350	1-2	25			90
Chlordane in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39351	50	30	56-142	56-142	90
	µg/kg	Alternate	EPA 1656	GC/ECD			25	69-133	69-133	90
Chloromethane in water	µg/L	Primary	EPA 8260B	GC/MS	30201	1	20	60-140	60-140	90
Chloromethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	88835	10	30	70-130	70-130	90
2-Chloronapthalene in water	µg/L	Primary	EPA 8270C	GC/MS	34581	4	30	60-125	60-125	90
2-Chloronapthalene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34584	660	30	60-130	60-130	90
2 -Chlorophenol in water	µg/L	Primary	EPA 8270C	GC/MS	34586	4	30	41-125	41-125	90
2 -Chlorophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34589	133	30	31-135	31-135	90
4-Chlorophenyl Phenyl Ether in water	µg/L	Primary	EPA 8270C	GC/MS	34641	4	30	51-132	51-132	90
4-Chlorophenyl Phenyl Ether in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34644	133	30	25-158	25-158	90
Chloropyrifos (Dursban) in water	µg/L	Primary	EPA 8141	GC/NPD	81403	0.5	25	45-118	45-118	90
Chloropyrifos (Dursban) in sediment	µg/kg	Primary	EPA 8141	GC/NPD	81404	50	30	40-129	40-129	90
Chrysene in water	µg/L	Primary	EPA 8270C	GC/MS	34320	4	30	55-133	55-133	90
Chrysene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34323	133	30	17-168	17-168	90
Cyanazine in water	µg/L	Primary	EPA 619	GC/NPD	81757	0.5	25	30-232	30-232	90
Cyanazine in sediment	µg/kg	Primary	EPA 619-m	GC/NPD	03999	50	30			90

Appendix E Data Quality Objectives for Measurement Data

2,4-D in water	µg/L	Primary	EPA 8151	GC/ECD	39730	0.5	25	72-146	72-146	90
2,4-D in sediment	µg/kg	Primary	EPA 8151	GC/ECD	39731	200	30	89-175	89-175	90
Demeton in water	µg/L	Primary	EPA 8141	GC/NPD	39560	1	25	14-107	14-107	90
Demeton in sediment	µg/kg	Primary	EPA 8141	GC/NPD	82400	100	30	5-108	5-108	90
Diazinon in water	µg/L	Primary	EPA 8141	GC/NPD	39570	0.1	25	34-126	34-126	90
Diazinon in sediment	µg/kg	Primary	EPA 8141	GC/NPD	39571	50	30	39-124	39-124	90
1,2-Dibromoethane in water	µg/L	Primary	EPA 8260B	GC/MS	77651	1	20	75-125	75-125	90
1,2-Dibromoethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	88805	10	30	70-130	70-130	90
Dicofol (Kelthane)in water	µg/L	Primary	EPA 8081	GC/ECD	39780	0.10	25			90
Dicofol (Kelthane)in sediment	µg/kg	Primary	EPA 8081	GC/ECD	79799	100	30			90
Dieldrin in water	µg/L	Primary	EPA 8081	GC/ECD	39380	0.02	25	52-120	52-120	90
		Alternate	EPA 1656	GC/ECD	39380	0.02	25	48-158	48-158	90
Dieldrin in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39383	50	30	56-125	56-125	90
		Alternate	EPA 1656	GC/ECD	38383		25	48-158	48-158	90
BromoDichloromethane in water	µg/L	Primary	EPA 8260B	GC/MS	32101	1	20	75-125	75-125	90
BromoDichloromethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34330	10	40	40-160	40-160	90
1,1-Dichloroethane in water	µg/L	Primary	EPA 8260B	GC/MS	34496	1	20	72-125	72-125	90
1,1-Dichloroethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34499	5	40	45-165	45-165	90
1,2-Dichloroethane in water	µg/L	Primary	EPA 8260B	GC/MS	34531	1	20	68-127	68-127	90
1,2-Dichloroethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34534	5	40	40-165	40-165	90
1,1-Dichloroethylene in water	µg/L	Primary	EPA 8260B	GC/MS	34501	1	20	75-125	75-125	90
1,1-Dichloroethylene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34504	5	40	15-260	15-260	90
1,2-Dichloropropane in water	µg/L	Primary	EPA 8260B	GC/MS	34541	1	20	70-125	70-125	90
1,2-Dichloropropane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34544	5	40	15-255	15-255	90
cis 1,3-Dichloropropene in water	µg/L	Primary	EPA 8260B	GC/MS	34704	1	20	74-125	74-125	90
cis 1,3-Dichloropropene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34702	10	30	70-130	70-130	90
1,3-Dichloropropylene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34565	10.	40	15-280	15-280	90
Diuron (Karmex) in water	µg/L	Primary	EPA 8321	HPLC/MS	39650	1	25	57-133	57-133	90
Diuron (Karmex)in sediment	µg/kg	Primary	EPA 8321	HPLC/MS	73030	20	25	25-133	25-133	90
DDT in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39373	50	30	36-129	36-129	90
	µg/kg	Alternate	EPA 1656	GC/ECD	39373	12	25	79-119	79-119	90
DDT in water	µg/L	Primary	EPA 8081	GC/ECD	39370	0.05	25	27-142	27-142	90
	µg/L	Alternate	EPA 1656	GC/ECD	39370	0.036	25	79-119		90
DDE in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39368	50	30	58-127	58-127	90
	µg/kg	Alternate	EPA 1656	GC/ECD	39368	4	25	54-126	54-126	90
DDE in water	µg/L	Primary	EPA 8081	GC/ECD	39365	0.05	25	29-120	29-120	90
		Alternate	EPA 1656	GC/ECD	39365	0.030	25	54-126		90
DDD in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39363	50	30	51-129	51-129	90
	µg/kg	Alternate	EPA 1656	GC/ECD	39363	11	25	57-129	57-129	90
DDD in water	µg/L	Primary	EPA 8081	GC/ECD	39360	0.05	25	44-119	44-119	90
			EPA 1656	GC/ECD	39360	0.015	25	57-129		90
Dibenzo (a,h) Anthracene in water	µg/L	Primary	EPA 8270C	GC/MS	34556	4	30	50-125	50-125	90
Dibenzo (a,h) Anthracene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34559	660	30	15-227	15-227	90
1,2-Dichlorobenzene in water	µg/L	Primary	EPA 8260B	GC/MS	34536	4	30	42-155	42-155	90
1,2-Dichlorobenzene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34539	660	30	32-130	32-130	90
1,3-Dichlorobenzene in water	µg/L	Primary	EPA 8260B	GC/MS	34566	4	30	36-125	36-125	90
1,3-Dichlorobenzene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34569	660	30	15-172	15-172	90
1,4-Dichlorobenzene in water	µg/L	Primary	EPA 8260B	GC/MS	34571	4	30	30-125	30-125	90
1,4-Dichlorobenzene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34574	660	30	20-130	20-130	90
3,3-Dichlorobenzidine in water	µg/L	Primary	EPA 8270C	GC/MS	34631	4	30	29-175	29-175	90

Appendix E Data Quality Objectives for Measurement Data

3,3-Dichlorobenzidine in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34634	133	30	15-262	15-262	90
trans-1,2-Dichloroethene in water	µg/L	Primary	EPA 8260B	GC/MS	34546	1	20	75-125	75-125	90
trans-1,2-Dichloroethene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34549	10	30	75-125	75-125	90
2,4 -Dichlorophenol in water	µg/L	Primary	EPA 8270C	GC/MS	34601	4	30	46-125	46-125	90
2,4 -Dichlorophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34604	133	30	36-135	36-135	90
trans-1,3-Dichloropropene in water	µg/L	Primary	EPA 8260B	GC/MS	34699	1	20	66-125	66-125	90
trans-1,3-Dichloropropene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34697	10	30	70-130	70-130	90
Diethyl Phthalate in water	µg/L	Primary	EPA 8270C	GC/MS	34336	10	30	37-125	37-125	90
Diethyl Phthalate in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34339	660	30	15-130	15-130	90
2,4 -Dimethylphenol in water	µg/L	Primary	EPA 8270C	GC/MS	34606	4	30	10-139	10-139	90
2,4 -Dimethylphenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34609	133	30	30-149	30-149	90
Dimethyl Phthalate in water	µg/L	Primary	EPA 8270C	GC/MS	34341	4	30	25-175	25-175	90
Dimethyl Phthalate in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34344	660	30	15-130	15-130	90
Di-n-Butyl Phthalate in water	µg/L	Primary	EPA 8270C	GC/MS	39110	10	30	34-136	34-136	90
Di-n-Butyl Phthalate in sediment	µg/kg	Primary	EPA 8270C	GC/MS	39112	330	30	1-130	1-130	90
4,6-Dinitro-ortho-cresol in water	µg/L	Primary	EPA 8270C	GC/MS	34657	10	30	26-134	26-134	90
4,6-Dinitro-ortho-cresol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34660	330	30	25-144	25-144	90
2,4-Dinitrophenol in water	µg/L	Primary	EPA 8270C	GC/MS	34616	20	30	30-151	30-151	90
2,4-Dinitrophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34619	660	30	25-161	25-161	90
2,4-Dinitrotoluene in water	µg/L	Primary	EPA 8270C	GC/MS	34611	4	30	39-139	39-139	90
2,4-Dinitrotoluene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34614	133	30	39-139	39-139	90
2,6-Dinitrotoluene in water	µg/L	Primary	EPA 8270C	GC/MS	34626	4	30	51-125	51-125	90
2,6-Dinitrotoluene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34629	133	30	50-158	50-158	90
Di-n-Octyl Phthalate in water	µg/L	Primary	EPA 8270C	GC/MS	34596	10	30	38-127	38-127	90
Di-n-Octyl Phthalate in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34599	660	30	4-146	4-146	90
Endosulfan in water	µg/L	Primary	EPA 8081	GC/ECD	39388	0.05	25	55-123	55-123	90
Endosulfan in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39389	50	30	56-142	56-142	90
Endosulfan Sulfate in water	µg/L	Primary	EPA 8081	GC/ECD	34351	0.05	25	51-126	51-126	90
Endosulfan Sulfate in sediment	µg/kg	Primary	EPA 8081	GC/ECD	34354	50	30	25-153	25-153	90
Endrin in water	µg/L	Primary	EPA 8081	GC/ECD	39390	0.05	25	40-138	40-138	90
Endrin in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39393	50	30	44-129	44-129	90
Ethylbenzene in water	µg/L	Primary	EPA 8260B	GC/MS	34371	1	20	75-125	75-125	90
Ethylbenzene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34374	5	40	25-175	25-175	90
Fluorene in water	µg/L	Primary	EPA 8270C	GC/MS	34381	4	30	48-139	48-139	90
Fluorene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34384	660	30	59-130	59-130	90
Fluoranthene in water	µg/L	Primary	EPA 8270C	GC/MS	34376	4	30	26-137	26-137	90
Fluoranthene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34379	133	30	26-137	26-137	90
Guthion (Azinphos methyl) in water	µg/L	Primary	EPA 8141	GC/NPD	39580	5.0	25	13-155	13-155	90
Guthion(Azinphos methyl) in sediment	µg/kg	Primary	EPA 8141	GC/NPD	39581	500	30	36-153	36-153	90
Heptachlor in water	µg/L	Primary	EPA 8081	GC/ECD	39410	0.05	25	12-122	12-122	90
Heptachlor in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39413	50	30	37-149	37-149	90

Appendix E Data Quality Objectives for Measurement Data

Heptachlor epoxide in water	µg/L	Primary	EPA 8081	GC/ECD	39420	0.05	25	52-121	52-121	90
		Alternate	EPA 1656	GC/ECD	39420	0.04	25	49-131	48-158	90
		Alternate/ Confirmatory	EPA 525.1	L/S Extraction + Capillary GC/MS	39420	0.7	25	49-131	48-158	90
Heptachlor epoxide in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39423	50	30	55-140	55-140	90
	µg/kg	Alternate	EPA 1656	GC/ECD	39423	1.0	25	49-131	49-131	90
Hexachlorobenzene in water	µg/L	Primary	EPA 8270C	GC/MS	39700	4	30	46-133	46-133	90
Hexachlorobenzene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	39701	133	30	15-152	15-152	90
Hexachlorobutadiene in water	µg/L	Primary	EPA 8260B	GC/MS	34391	1	20	59-128	59-128	90
Hexachlorobutadiene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	39705	5	30	24-130	24-130	90
Hexachlorocyclopentadiene in water	µg/L	Primary	EPA 8270C	GC/MS	34386	10	30	20-125	20-125	90
Hexachlorocyclopentadiene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34389	330	30	31-135	31-135	90
Hexachloroethane in water	µg/L	Primary	EPA 8270C	GC/MS	34396	4	30	25-153	25-153	90
Hexachloroethane in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34399	133	30	40-130	40-130	90
Indeno[1,2,3-cd]pyrene in water	µg/L	Primary	EPA 8270C	GC/MS	34403	4	30	27-160	27-160	90
Indeno[1,2,3-cd]pyrene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34406	133	30	25-170	25-170	90
Isophorone in water	µg/L	Primary	EPA 8270C	GC/MS	34408	4	30	26-175	26-175	90
Isophorone in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34411	133	30	25-175	25-175	90
Malathion in water	µg/L	Primary	EPA 8141	GC/NPD	39530	0.5	25	40-132	40-132	90
Malathion in sediment	µg/kg	Primary	EPA 8141	GC/NPD	39531	50	30	45-127	45-127	90
Methoxychlor in water	µg/L	Primary	EPA 8081	GC/ECD	39480	0.05	25	39-160	39-160	90
Methoxychlor in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39481	50	30	37-144	37-144	90
Methyl Bromide in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34416	5	40	15-305	15-305	90
Methyl Chloride in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34421	5	40	15-320	15-320	90
Methylene Chloride in water	µg/L	Primary	EPA 8260B	GC/MS	34423	1	20	75-125	75-125	90
Methylene Chloride in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34426	5	40	15-250	15-250	90
3-Methyl-4-Chlorophenol in water	µg/L	Primary	EPA 8270C	GC/MS	34452	4	30	44-125	44-125	90
3-Methyl-4-Chlorophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34455	133	30	34-135	34-135	90
Methyl naphthalene	µg/kg	Primary	EPA 8270C	GC/MS	45502	660	30	21-133	21-133	90
2-Methyl phenol in water	µg/L	Primary	EPA 8270C	GC/MS	77152	4	30	25-125	25-125	90
4-Methyl phenol (o-cresol)in water	µg/L	Primary	EPA 8270C	GC/MS	77146	4	30	25-125	25-125	90
2-Methyl phenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	78872	134	30	25-135	25-135	90
4-Methyl phenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	78803	134	30	25-135	25-135	90
Methyl tert-butyl ether in water	µg/L	Primary	EPA 8260B	GC/MS	46491	5	20	65-135	65-135	90
Methyl tert-butyl ether in sediment	µg/kg	Primary	EPA 8260B	GC/MS	50928	10	30	70-130	70-130	90
Metolachlor in water	µg/L	Primary	EPA 8141	GC/NPD	82612	0.5	25			90
Metolachlor in sediment	µg/kg	Primary	EPA 8141	GC/NPD	38923	50	30			90
Mirex in water	µg/L	Primary	EPA 8081	GC/ECD	39755	0.1	25			90
Mirex in sediment	µg/kg	Primary	EPA 8081	GC/ECD	79800	100	30			90
Naphthalene in water	µg/L	Primary	EPA 8270C	GC/MS	34696	4	30	50-125	50-125	90
Naphthalene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34445	660	30	21-133	21-133	90
Nitrobenzene in water	µg/L	Primary	EPA 8270C	GC/MS	34447	4	30	46-133	46-133	90
Nitrobenzene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34450	133	30	36-143	36-143	90
N-Nitrosodiphenylamine in water	µg/L	Primary	EPA 8270C	GC/MS	34433	4	30	27-125	27-125	90
N-Nitrosodiphenylamine in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34436	133	30	25-135	25-135	90

Appendix E Data Quality Objectives for Measurement Data

N-Nitrosodi-n-propylamine in water	µg/L	Primary	EPA 8270C	GC/MS	34428	4	30	37-125	37-125	90
N-Nitrosodi-n-propylamine in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34431	133	30	27-135	27-135	90
2-Nitrophenol in water	µg/L	Primary	EPA 8270C	GC/MS	34591	4	30	44-125	44-125	90
2-Nitrophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34594	133	30	34-135	34-135	90
4-Nitrophenol in water	µg/L	Primary	EPA 8270C	GC/MS	34646	4	30	15-131	15-131	90
4-Nitrophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34649	133	30	25-141	25-141	90
Parathion in water	µg/L	Primary	EPA 8141	GC/NPD	39540	0.5	25	39-136	39-136	90
Parathion in sediment	µg/kg	Primary	EPA 8141	GC/NPD	39541	50	30	33-139	33-139	90
Pentachlorophenol in water	µg/L	Primary	EPA 8270C	GC/MS	39032	4	30	28-136	28-136	90
Pentachlorophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	39061	133	30	38-146	38-146	90
Pyrene in water	µg/L	Primary	EPA 8270C	GC/MS	34469	4	30	47-136	47-136	90
Pyrene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34472	660	30	52-130	52-130	90
Phenanthrene in water	µg/L	Primary	EPA 8270C	GC/MS	34461	4	30	54-125	54-125	90
Phenanthrene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34464	13310	30	54-130	54-130	90
Phenol in water	µg/L	Primary	EPA 8270C	GC/MS	34694	4	30	15-125	15-125	90
Phenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34695	133	30	25-135	25-135	90
PCBs in water total	µg/L	Primary	EPA 8082	GC/ECD	39516	0.5	25	30-117	30-117	90
		Alternate	EPA 1656	GC/ECD	39516	0.35	25	75-119	75-119	90
PCB-1242 in water	µg/L	Primary	EPA 8082	GC/ECD	39496	0.35	25			90
		Alternate	EPA 1656	GC/ECD	39496	0.35	25	75-119	75-119	90
PCB-1254 in water	µg/L	Primary	EPA 8082	GC/ECD	39504	0.35	25			90
		Alternate	EPA 1656	GC/ECD	39504	0.35	25	75-119	75-119	90
PCB-1221 in water	µg/L	Primary	EPA 8082	GC/ECD	39488	0.35	25			90
		Alternate	EPA 1656	GC/ECD	39488	0.35	25	75-119	75-119	90
PCB-1232 in water	µg/L	Primary	EPA 8082	GC/ECD	39492	0.35	25			90
		Alternate	EPA 1656	GC/ECD	39492	0.35	25	75-119	75-119	90
PCB-1248 in water	µg/L	Primary	EPA 8082	GC/ECD	39500	0.35	25			90
		Alternate	EPA 1656	GC/ECD	39500	0.35	25	75-119	75-119	90
PCB-1260 in water	µg/L	Primary	EPA 8082	GC/ECD	39508	0.35	25			90
		Alternate	EPA 1656	GC/ECD	39508	0.35	25	75-119	75-119	90
PCB-1016 in water	µg/L	Primary	EPA 8082	GC/ECD	34671	0.35	25			90
		Alternate	EPA 1656	GC/ECD	34671	0.35	25	75-119	75-119	90
PCBs in sediment total	µg/kg	Primary	EPA 8082	GC/ECD	39519	200	30			90
	µg/kg	Alternate	EPA 1656	GC/ECD	39519	1.0	25	75-119	75-119	90
PCB-1242 In Sediment	µg/kg	Primary	EPA 8082	GC/ECD	39499	200	30			90
	µg/kg	Alternate	EPA 1656	GC/ECD	39499	1.0	25	75-119	75-119	90
PCB-1254 In Sediment	µg/kg	Primary	EPA 8082	GC/ECD	39507	200	30			90
	µg/kg	Alternate	EPA 1656	GC/ECD	39507	1.0	25	75-119	75-119	90

Appendix E Data Quality Objectives for Measurement Data

PCB-1221 In Sediment	µg/kg	Primary	EPA 8082	GC/ECD	39491	200	30			90
PCB-1221 In Sediment	µg/kg	Alternate	EPA 1656	GC/ECD	39491	1.0	25	75-119	75-119	90
PCB-1232 In Sediment	µg/kg	Primary	EPA 8082	GC/ECD	39495	200	30			90
	µg/kg	Alternate	EPA 1656	GC/ECD	39495	1.0	25	75-119	75-119	90
PCB-1248 In Sediment	µg/kg	Primary	EPA 8082	GC/ECD	39503	200	30			90
	µg/kg	Alternate	EPA 1656	GC/ECD	39503	1.0	25	75-119	75-119	90
PCB-1260 In Sediment	µg/kg	Primary	EPA 8082	GC/ECD	39511	200	30	61-118	61-118	90
	µg/kg	Alternate	EPA 1656	GC/ECD	39511	1.0	25	75-119	75-119	90
PCB-1016 In Sediment	µg/kg	Primary	EPA 8082	GC/ECD	39514	200	30	56-113	56-113	90
	µg/kg	Alternate	EPA 1656	GC/ECD	39514	1.0	25	75-119	75-119	90
Simazine in water	µg/L	Primary	EPA 8141	GC/NPD	39055	0.5	25	35-135	35-135	90
Simazine in sediments	µg/L	Primary	EPA 8141	GC/NPD	39046	50	30	35-135	35-135	90
2,4,5-T in water	µg/L	Primary	EPA 8151	GC/ECD	39740	0.10	25	45-134	45-134	90
2,4,5-T in sediment	µg/kg	Primary	EPA 8151	GC/ECD	39741	40	30	48-153	48-153	90
2,4,5-TP (Silvex) in water	µg/L	Primary	EPA 8151	GC/ECD	39760	0.1	25	46-125	46-125	90
2,4,5-TP (Silvex) in sediment	µg/kg	Primary	EPA 8151	GC/ECD	39761	40	30	54-145	54-145	90
1,1,2,2-Tetrachloroethane in water	µg/L	Primary	EPA 8260B	GC/MS	34516	1	20	74-125	74-125	90
1,1,2,2-Tetrachloroethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34519	5	40	35-170	35-170	90
Tetrachloroethene in water	µg/L	Primary	EPA 8260B	GC/MS	34475	1	20	71-125	71-125	90
Tetrachloroethene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34478	10	30	70-130	70-130	90
1,2,4-Trichlorobenzene in water	µg/L	Primary	EPA 8270C	GC/MS	34551	4	30	44-142	44-142	90
1,2,4-Trichlorobenzene in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34554	133	30	34-152	34-152	90
Trichloroethylene in water	µg/L	Primary	EPA 8260B	GC/MS	39180	1	20	71-125	71-125	90
Trichloroethylene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34487	10	40	60-170	60-170	90
1,1,1-trichloro-ethane in water	µg/L	Primary	EPA 8260B	GC/MS	34506	1	20	75-125	75-125	90
1,1,1-trichloro-ethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34509	5	25	70-130	70-130	90
1,1,2-trichloro-ethane in water	µg/L	Primary	EPA 8260B	GC/MS	34511	1	20	75-127	75-127	90
1,1,2-trichloro-ethane in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34514	5	25	70-130	70-130	90
2,4,5-Trichlorophenol in water	µg/L	Primary	EPA 8270C	GC/MS	77687	4	30	25-175	25-175	90
2,4,5-Trichlorophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	78401	133	30	25-175	25-175	90
2,4,6-Trichlorophenol in water	µg/L	Primary	EPA 8270C	GC/MS	34621	4	30	39-128	39-128	90
2,4,6-Trichlorophenol in sediment	µg/kg	Primary	EPA 8270C	GC/MS	34624	133	30	29-138	29-138	90
Toluene in water	µg/L	Primary	EPA 8260B	GC/MS	34010	1	20	74-125	74-125	90
Toluene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34483	10	30			90
Toxaphene in water	µg/L	Primary	EPA 8081	GC/ECD	39400	1.0	25	28-131	28-131	90
Toxaphene in water		Alternate	EPA 1656	GC/ECD	39400	2.7	25	76-122		90
		Alternate/ Confirmatory	EPA 525.1	L/S Extraction + Capillary GC/MS	39400	20	25			90
Toxaphene in sediment	µg/kg	Primary	EPA 8081	GC/ECD	39403	500	30	21-113	21-113	90
	µg/kg	Alternate	EPA 1656	GC/ECD	39403	5.0	25	76-122		90

Appendix E Data Quality Objectives for Measurement Data

Vinyl Chloride in water	µg/L	Primary	EPA 8260B	GC/MS	39175	1	20	46-134	46-134	90
Vinyl Chloride in sediment	µg/kg	Primary	EPA 8260B	GC/MS	34495	10	40	15-325	15-325	90
m,p-xylene in water	µg/L	Primary	EPA 8260B	GC/MS	85795	1	20	75-125	75-125	90
o-xylene in water	µg/L	Primary	EPA 8260B	GC/MS	77135	1	20	75-125	75-125	90
m,p-xylene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	45516	10	30	70-130	70-130	90
o-xylene in sediment	µg/kg	Primary	EPA 8260B	GC/MS	78402	10	30	70-130	70-130	90
Tributyltin in water	µg/L	Primary	EV-024/025		30340	0.010	25			90
Toxicity in ambient marine water	% Survival Yes/No*	*Mysidopsis bahia*	EPA 600-4-91-003; 1007.0	Chronic Toxicity Screening Test	89805	NA	NA	NA	NA	90
Toxicity in ambient marine water	% Survival Yes/No*	*Menidia Berrylina*	EPA 600-4-91-003; 1006.0	Chronic Toxicity Screening Test	89806	NA	NA	NA	NA	90
Toxicity in marine sediment	% Survival Yes/No*	*Leptocheirus*	EPA 600-R-94-025; 100.4	Whole Sediment Toxicity Test	89815	NA	NA	NA	NA	90
Toxicity in marine sediment	% Survival Yes/No*	*Neanthes*	EPA 823-B-98-004	Whole Sediment Toxicity Test	89816	NA	NA	NA	NA	90
Freshwater toxicity	% Survival Yes/No*	*Ceriodaphnia dubia*	EPA 600-4-91-002; 1002.0	7-day subchronic test for survival, reproduction	89802	NA	NA	NA	NA	90
Freshwater toxicity	% Survival Yes/No*	*Pimephales promelas*	EPA 600-4-91-002; 1000.0	7-day test for larval survival, growth	89803	NA	NA	NA	NA	90
Toxicity for freshwater whole sediments	% Survival Yes/No	*Hyallela azteca*	EPA 600-R-94-024; 100.1	10-day survival test for sediments	89813	NA	NA	NA	NA	90
Toxicity for freshwater whole sediments	% Survival Yes/No	*Chironomus tentans*	EPA 600-R-94-024; 100.2	10-day survival and growth tests for sediments	89814	NA	NA	NA	NA	90
Benthic Macro invertebrate sampling	number	counts	TCEQ SOP	TCEQ SOP	Texas Species Code**	NA	NA	NA	NA	90
Nekton Sampling	number	counts	TCEQ SOP	TCEQ SOP	Texas Species Code**	NA	NA	NA	NA	90
Stream Habitat	NA	Counts	TCEQ SOP	TCEQ SOP	NA	NA	NA	NA	NA	90
Sediment Core Upper Depth	Inches	Grab	TCEQ SOP	TCEQ SOP	81900	NA	NA	NA	NA	90
Sediment Core Lower Depth	Inches	Grab	TCEQ SOP	TCEQ SOP	81901	NA	NA	NA	NA	90

* 1 = toxic; 2 = sublethal; 3 = none

** Individual species will be reported by TCEQ species code (TCEQ 1999)

DATA VERIFICATION REPORT

for sediment samples collected from Segment 2201,

ARROYO COLORADO TIDAL TMDL SITE

June 11, 2001

Data Verification by: Sandra de las Fuentes

The following data verification summary report covers environmental sediment samples collected from the Arroyo Colorado Tidal Segment 2201, Station 13782, on June 11, 2001.

A Chemist with Parsons has reviewed the data submitted by DHL Analytical, B&B Laboratories, APPL, Inc. and TRAC Environmental Technology and Chemistry.

The sample in this event was not collected during the specified sampling event (May, 2001), due to mechanical problems experienced by the field crew. The sample was collected following the normal protocol on June11, 2001.

The sample in this event was analyzed for volatiles, semivolatiles pesticides (including triazines, PCBs, organophosphorus compounds, herbicides and carbamates), total metals, anions, simultaneously extracted metals (SEM), acid volatile sulfide (AVS), total organic carbon (TOC) and grain size.

There were no field quality control samples collected at this site. No trip blanks were analyzed for volatiles and no field blanks or equipment blanks were collected in association with the sediment samples in this DVR. Therefore, the possibility of contamination during sampling or handling could not be evaluated for these samples.

All samples were collected by Parsons and were analyzed by the various laboratories following procedures outlined in the Assessment of the Presence and Causes of Ambient Toxicity Quality Assurance Project Plan (QAPP).

REVIEW CRITERIA

All data submitted by the various laboratories has been reviewed. Field and laboratory QC sample information was examined, including: laboratory blanks, laboratory control samples (LCS), laboratory duplicates, standard reference material (SRM) samples, matrix spikes and matrix spike duplicate (MS and MSD) samples, surrogate spikes and Chain-of-Custody (COC) forms. The findings presented in this report are based on the reviewed information and whether the requirements specified in the project QAPP were met.

VOLATILES

General

This sample group consisted of three (3) samples including one (1) environmental sediment sample and one pair of MS/MSD samples, randomly selected by the laboratory. The samples were collected on June 11, 2001, and were analyzed for volatile organic compounds (VOCs). The VOC analyses were performed using USEPA SW846 Method 8260B.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the MS/MSD samples, LCS samples and surrogate spikes. Sample 13782 was randomly selected by the laboratory and analyzed as the MS/MSD. It should be noted that only a small subset of analytes was reported for the MS/MSD.

The percent recoveries for the LCS were all within acceptance criteria with the exception of the following:

Sample	Analyte	%R	QC Criteria
LCS	Bromomethane	67.4	70-130

The sample result for bromomethane was ND and possibly biased low. Since bromomethane was only slightly below the lower acceptance limit for percent recovery, data quality should not be affected by these results, so no corrective action was necessary.

The percent recoveries for the MS/MSD were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and

- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was analyzed in association with the samples. The blank was free of target analytes above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All volatile results for the samples in this report were considered usable. The completeness for the VOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

SEMIVOLATILES

General

This sample group consisted of three (3) samples including one (1) environmental sediment sample and one pair of MS/MSD samples, randomly selected by the laboratory. The samples were collected on June 11, 2001, and were analyzed for semivolatile organic compounds (SVOCs). The SVOC analyses were performed using USEPA SW846 Method 8270C.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the MS/MSD samples, LCS samples, and the surrogate spikes. Sample 13782 was randomly selected by the laboratory and analyzed as the MS/MSD. It should be noted that only a small subset of analytes was reported for the MS/MSD.

All MS/MSD and surrogate %Rs were within acceptance criteria.

All LCS %Rs were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and

- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was analyzed in association with the samples. The blank was free of target analytes above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All semivolatile results for the samples in this report were considered usable. The completeness for the SVOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TRIAZINES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for triazines. The triazine compounds, atrazine, cyanazine, metolachlor and simazine, were analyzed using USEPA SW846 Method 8141A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.

The LCS percent recoveries were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the triazine analyses. The blank was free of any triazines above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All triazine results for the sample in this report were considered usable. The completeness for the triazine portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

PESTICIDES / PCBS

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for pesticides and PCBs. The pesticide/PCB analyses were performed using USEPA SW846 Method 8081A/8082.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the pesticide/PCB analyses. The blank was free of any pesticides or PCBs of concern above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All pesticide/PCB results for the samples in this report were considered usable. The completeness for the pesticide/PCB portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

ORGANOPHOSPHORUS COMPOUNDS

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for organophosphorus compounds. The organophosphorus compounds, Chloropyrifos, Demeton, Diazinon, Guthion, Malathion and Parathion were analyzed using USEPA SW846 Method 8141A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.

The LCS percent recoveries were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the organophosphorus compound analyses. The blank was free of any organophosphorus compounds above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All organophosphorus compound results for the sample in this report were considered usable. The completeness for the organophosphorus compound portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

HERBICIDES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for herbicides. Herbicides, 2,4,5-T, 2,4,5-TP (Silvex) and 2,4-D, were analyzed using USEPA SW846 Method 8151A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and the surrogate spike.

The LCS percent recoveries were within acceptance criteria.

The surrogate spike recovery met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

The method blank was run in association with the herbicide analyses. The blank was free of any herbicides above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All herbicide results for the samples in this report were considered usable. The completeness for the herbicides portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

CARBAMATES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for carbamates. The carbamate compounds, carbaryl and diuron were analyzed using USEPA SW846 Method 8321A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.
The LCS percent recoveries were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the carbamate analyses. The blank was free of any carbamates of concern above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All carbamate results for the samples in this report were considered usable. The completeness for the carbamates portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TOTAL METALS AND IONS

General

This sample group consisted of three (3) samples, including one (1) environmental sediment sample and one pair of MS/MSD samples, randomly selected by the laboratory. The samples were collected on June 11, 2001 and were analyzed for total metals (aluminum, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, silver, sodium and zinc). The mercury analyses were performed using USEPA SW846 Method 7471A. All other metals were determined using USEPA SW846 Method 6020B.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and MS/MSD samples. Sample 13782 was randomly selected by the laboratory and analyzed as the

MS/MSD for this data set for all metals except mercury. Another clients sample was selected for the MS/MSD for the batch QC for mercury.

All LCS %Rs met acceptance criteria.

All MS and MSD %Rs met acceptance criteria except for the following:

MS/MSD Sample ID	Analyte	MS %R	MSD %R	QC Criteria
13782	Aluminum	-448	-323	80-120%
	Barium	48.3	21.3	
	Calcium	-1300	-834	
	Iron	-276	-245	
	Mercury	(100)	129	
	Magnesium	-93.4	-13.1	
	Potassium	-48.6	-26.5	
	Sodium	1.95	63.5	
	Zinc	76	(90.4)	

( ) indicates recovery met criteria.

For aluminum, calcium, iron, magnesium, potassium and sodium, the sample concentration was significantly greater (over 4 times) than the spike concentration, so no corrective action was necessary for this metal. The result for barium was considered estimated and flagged "J" due to the non-compliant recovery. The result for mercury was above acceptance criteria for recovery and the sample was ND, therefore no corrective action was necessary. The sample result for zinc may possible be biased low although was not flagged since the recovery for the MS was only slightly below acceptance criteria and the recovery for the MSD was acceptable.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries and field duplicate analyte values.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP with the exceptions noted above.

All samples were prepared and analyzed within the hold time required by the method.

All laboratory blanks were free of target analytes above the MAL.

No calibration, analytical spike or dilution test information was provided for the analyses.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metals results for the samples in this report were considered usable. The completeness for the metals portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

ANIONS (CHLORIDE AND SULFATE)

General

This sample group consisted of one two (2) samples, including one (1) environmental sediment sample and a laboratory duplicate, randomly selected by the laboratory. The samples were collected on June 11, 2001 and were analyzed for chloride and sulfate using USEPA SW846 Method 9056.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and LCSD samples.

All LCS and LSCD %Rs met acceptance criteria.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the LCS/LCSD recoveries and field duplicate analyte values. Sample 13782 was randomly selected by the laboratory and analyzed as a field duplicate.

LCS/LCSD RPDs were within laboratory specified acceptance criteria for chloride and sulfate.

Chloride and sulfate met the QAPP tolerance for the laboratory duplicate samples.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP.

All samples were prepared and analyzed within the hold time required by the method.

All laboratory blanks were free of target analytes above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metals results for the samples in this report were considered usable. The completeness for the metals portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

SEM IN SEDIMENT

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for Simultaneously Extracted Metals (SEM), including cadmium, copper, lead, mercury, nickel, silver and zinc.

The metals analyses were performed using a modified EPA 1620 method, which is equivalent to EPA 200.7 and EPA 245.5.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and MS/MSD samples. Another client's sample was used for the MS/MSD for the batch QC for this group. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this group.

All LCS %Rs met QAPP acceptance criteria.

There was no accuracy data provided for silver and mercury.

No accuracy criteria for the MS/MSD samples were listed in the QAPP for the SEM analyses. The tolerances listed for metals analyses were used to evaluate the MS/MSD samples.

All MS %Rs met the QAPP metals acceptance criteria except for the following:

Analyte	MS %R	MSD %R	QC Criteria
Copper	76	79	80-120%
Lead	(109)	265	
Zinc	136	(101)	

( ) indicates recovery met criteria

Because no tolerances were specified in the QAPP for SEM matrix spike accuracy and since this sample is from another client, no corrective action was necessary.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within acceptance criteria with the exception of the following:

Analyte	MS %R	MSD %R	RPD
Lead	109	265	84%

Since this sample is from another client, no corrective action was necessary.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP.

All samples were prepared and analyzed within the hold time specified in the QAPP.

All laboratory blanks were reviewed and found to be free of SEM above the MAL, except for the following:

Sample ID	Analyte	Conc. (ug/dry g)	MDL (ug/dry g)
MB	Zinc	3.09	0.24

A "U" flag was applied to the zinc concentration in the sample since the zinc result in the method blank was only 3 times less than the zinc result in the sample. The concentration for zinc was adjusted by multiplying the method blank concentration by 5 times. Therefore, the adjusted concentration for zinc is 15.5 ug/dry g.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All SEM results for the samples in this report were considered usable. The completeness for the SEM portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

AVS IN SEDIMENT

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for Acid Volatile Sulfide (AVS). The AVS analyses were performed using EPA method 376.3.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and MS/MSD samples. Another client's sample was used for the MS/MSD for the batch QC for this group. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this group.

All LCS %Rs met acceptance criteria.

All MS and MSD %Rs met acceptance criteria.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP with the exceptions noted above.

All samples were prepared and analyzed within the hold time required by the QAPP.

All laboratory blanks were reviewed and found to be free of AVS at the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All AVS results for the samples in this report were considered usable. The completeness for the AVS portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TOC

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for total organic carbon (TOC). The TOC analyses were performed using B&B Laboratories, Inc. Standard Operating Procedure 1005.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the standard reference material (SRM) samples.

TOC met acceptance criteria in both SRM samples analyzed.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

Two method blanks were analyzed in association with the samples. Both blanks were free of TOC at the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All TOC results for the samples in this report were considered usable. The completeness for the TOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

GRAIN SIZE

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on June 11, 2001, and was analyzed for grain size by GS-92-01-B&B Method. Grain size results are reported as a percent of sand, silt or clay based on the weight of the sample.

Accuracy

Accuracy could not be evaluated by this method.

Precision

Precision could not be evaluated by this method.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

There were no method blanks required by this method.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All results for grain size for the sample in this report were considered usable. The completeness for the grain size compound portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

DATA VERIFICATION REPORT

for sediment samples collected from Segment 2201,

ARROYO COLORADO TIDAL TMDL SITE

July 20, 2001 and August 10, 2001

Data Verification by: Sandra de las Fuentes

The following data verification summary report covers environmental sediment samples collected from the Arroyo Colorado Tidal Segment 2201, Station 13782, on July 20, 2001 and August 10, 2001.

A Chemist with Parsons has reviewed the data submitted by DHL Analytical, B&B Laboratories, APPL, Inc. and TRAC Environmental Technology and Chemistry.

The sample in this event was collected during the specified sampling event (July, 2001), although the cooler sent to DHL Analytical was lost during shipment. The sample was re-collected following the normal protocol on August 10, 2001. All other analyses were performed on the samples collected on July 20, 2001.

The sample in this event was analyzed for volatiles, semivolatiles pesticides (including triazines, PCBs, organophosphorus compounds, herbicides and carbamates), total metals, anions, simultaneously extracted metals (SEM), acid volatile sulfide (AVS), total organic carbon (TOC) and grain size.

There were no field quality control samples collected at this site. No trip blanks were analyzed for volatiles and no field blanks or equipment blanks were collected in association with the sediment samples in this DVR. Therefore, the possibility of contamination during sampling or handling could not be evaluated for these samples.

All samples were collected by Parsons and were analyzed by the various laboratories following procedures outlined in the Assessment of the Presence and Causes of Ambient Toxicity Quality Assurance Project Plan (QAPP).

REVIEW CRITERIA

All data submitted by the various laboratories has been reviewed. Field and laboratory QC sample information was examined, including: laboratory blanks, laboratory control samples (LCS), laboratory duplicates, standard reference material (SRM) samples, matrix spikes and matrix spike duplicate (MS and MSD) samples, surrogate spikes and Chain-of-Custody (COC) forms. The findings presented in this report are based on the reviewed information and whether the requirements specified in the project QAPP were met.

VOLATILES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on August 10, 2001, and was analyzed for volatile organic compounds (VOCs). The VOC analyses were performed using USEPA SW846 Method 8260B.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes. Another client's sample was used for the MS/MSD for the batch QC for this group. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this group. It should be noted that only a small subset of analytes was reported for the MS/MSD.

The percent recoveries for the LCS were all within acceptance criteria.

The percent recoveries for the MS/MSD were within acceptance criteria except for the following:

Sample	Analyte	%R	QC Criteria
MS	1,1-Dichloroethene	148	70-130
MSD	1,1-Dichloroethene	151	70-130

No action was taken since the sample spiked was taken from another client.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was analyzed in association with the samples. The blank was free of target analytes above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All volatile results for the samples in this report were considered usable. The completeness for the VOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

SEMIVOLATILES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on August 10, 2001, and was analyzed for semivolatile organic compounds (SVOCs). The SVOC analyses were performed using USEPA SW846 Method 8270C.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and the surrogate spikes. Another client's sample was used for the MS/MSD for the batch QC for this group. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this group. It should be noted that only a small subset of analytes was reported for the MS/MSD.

All LCS %Rs were within acceptance criteria.

All MS/MSD and surrogate %Rs were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was analyzed in association with the samples. The blank was free of target analytes above the MAL except for the following:

Analyte	Concentration in MB (mg/Kg)	MDL in Sample (mg/Kg-dry)
2-Methylnaphthalene	0.08	0.0260
Naphthalene	0.126	0.051

The sample was non-detect down to the MDL for 2-methylnaphthalene and naphthalene, therefore no corrective actions were necessary.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All semivolatile results for the samples in this report were considered usable. The completeness for the SVOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TRIAZINES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for triazine. The triazine compounds, atrazine, cyanazine, metolachlor and simazine, were analyzed using USEPA SW846 Method 8141A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the MS/MSD samples, LCS sample and surrogate spikes. A sample from another TMDL site was selected as the MS/MSD for this QC batch. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this data group.

The LCS percent recoveries were within acceptance criteria.

All MS/MSD percent recoveries were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the triazine analyses. The blank was free of any triazines above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All triazine results for the sample in this report were considered usable. The completeness for the triazine portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

PESTICIDES / PCBS

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for pesticides and PCBs. The pesticide/PCB analyses were performed using USEPA SW846 Method 8081A/8082.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample, MS/MSD samples and surrogate spikes. A sample from another TMDL site was selected as the MS/MSD for this QC batch. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this data group.

The LCS percent recoveries were within acceptance criteria.

All MS/MSD percent recoveries were within acceptance criteria except for the following:

Analyte	MS %R	MSD %R	Tolerance
Methoxychlor	34.3	(41.6)	37-144
DDT	26.5	32.6	36-129

( ) indicates recovery met criteria.

The sample in this data set was not flagged for the non-compliant %Rs since the spiked sample was taken from another TMDL site.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the pesticide/PCB analyses. The blank was free of any pesticides or PCBs of concern above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All pesticide/PCB results for the samples in this report were considered usable. The completeness for the pesticide/PCB portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

ORGANOPHOSPHORUS COMPOUNDS

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for organophosphorus compounds. The

organophosphorus compounds, Chloropyrifos, Demeton, Diazinon, Guthion, Malathion and Parathion were analyzed using USEPA SW846 Method 8141A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample, MS/MSD samples, and surrogate spikes. A sample from another TMDL site was selected as the MS/MSD for this QC batch. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this data group.

The LCS percent recoveries were within acceptance criteria.

All MS/MSD percent recoveries were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the organophosphorus compound analyses. The blank was free of any organophosphorus compounds above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All organophosphorus compound results for the sample in this report were considered usable. The completeness for the organophosphorus compound portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

HERBICIDES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for herbicides. Herbicides, 2,4,5-T, 2,4,5-TP (Silvex) and 2,4-D, were analyzed using USEPA SW846 Method 8151A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample.

The LCS percent recoveries were within acceptance criteria.

The surrogate spike recovery met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

The method blank was run in association with the herbicide analyses. The blank was free of any herbicides above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All herbicide results for the samples in this report were considered usable. The completeness for the herbicide portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

CARBAMATES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for carbamates. The carbamate compounds, carbaryl and diuron were analyzed using USEPA SW846 Method 8321A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample, MS/MSD samples and surrogate spikes. A sample from another TMDL site was selected

as the MS/MSD for this QC batch. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this data group.

The LCS percent recoveries were within acceptance criteria.

All MS/MSD percent recoveries were within acceptance criteria except for the following:

Analyte	MS %R	Tolerance
Diuron	163	25-133

The sample in this data set was not flagged for the non-compliant %Rs since the spiked sample was taken from another TMDL site.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD.

The MS/MSD RPDs were outside of laboratory specified acceptance criteria as indicated in the following:

Analyte	MS %R	MSD %R	RPD	Lab Tolerance
Carbaryl	41.4	63.7	42.3	25%
Diuron	100	163	47.9	

The sample in this data set was not flagged for the non-compliant %Rs since the spiked sample was taken from another TMDL site.

All field duplicate RPDs were within acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the carbamate analyses. The blank was free of any carbamates of concern above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All carbamate results for the samples in this report were considered usable. The completeness for the carbamates portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TOTAL METALS AND IONS

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on August 10, 2001 and was analyzed for total metals (aluminum, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, silver, sodium and zinc). The mercury analyses were performed using USEPA SW846 Method 7471A. All other metals were determined using USEPA SW846 Method 6020B.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS. A sample from another TMDL location was used for the MS/MSD for the batch QC for this group. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this group. The laboratory randomly selected this sample for the MS/MSD for the batch QC for mercury.

All LCS %Rs met acceptance criteria.

All MS and MSD %Rs met acceptance criteria except for the following:

MS/MSD Sample ID	Analyte	MS %R	MSD %R	QC Criteria
13782	Aluminum	-137	-412	80-120%
	Calcium	(94.7)	-67.7	
	Iron	-17	-152	
	Magnesium	(87.2)	35.6	
	Potassium	(82.7)	62	
	Sodium	78	-3.0	

( ) indicates recovery met criteria.

For aluminum, calcium, iron, magnesium and sodium, the sample concentration was significantly greater (over 4 times) than the spike concentration. The result for potassium in the sample may be biased low, although no flag was applied since the sample spiked was taken from a different TMDL location.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries and field duplicate analyte values.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP with the exceptions noted above.

All samples were prepared and analyzed within the hold time required by the method.

All laboratory blanks were free of target analytes above the MAL.

No calibration, analytical spike or dilution test information was provided for the analyses.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metals results for the samples in this report were considered usable. The completeness for the metals portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

ANIONS (CHLORIDE AND SULFATE)

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on August 10, 2001 and was analyzed for chloride and sulfate using USEPA SW846 Method 9056.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and LCSD samples.

All LCS and LSCD %Rs met acceptance criteria.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the LCS/LCSD recoveries.

LCS/LCSD RPDs were within laboratory specified acceptance criteria for chloride and sulfate.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP.

All samples were prepared and analyzed within the hold time required by the method.

All laboratory blanks were free of target analytes above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metals results for the samples in this report were considered usable. The completeness for the metals portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

SEM IN SEDIMENT

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for Simultaneously Extracted Metals (SEM), including cadmium, copper, lead, mercury, nickel, silver and zinc.

The metals analyses were performed using a modified EPA 1620 method, which is equivalent to EPA 200.7 and EPA 245.5.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and MS/MSD samples. A sample from another TMDL site was used for the MS/MSD for the batch QC for this group. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this group.

All LCS %Rs met QAPP acceptance criteria.

No accuracy criteria for the MS/MSD samples were listed in the QAPP for the SEM analyses. The tolerances listed for metals analyses were used to evaluate the MS/MSD samples.

All MS/MSD %Rs met the QAPP metals acceptance criteria except for the following:

Analyte	MS %R	MSD %R	QC Criteria
Silver	0	0	
Cadmium	72	(86)	
Copper	0	0	80-120%
Lead	0	52	
Zinc	65	147	

( ) indicates recovery met criteria

The laboratory explained the observed variances as a product of sample inhomogeneity and matrix interference. There were no flags applied since the sample spiked was taken from a different TMDL site.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within laboratory specified acceptance criteria with the exception of the following:

Analyte	MS Conc (ug/kg)	MSD Conc. (ug/kg)	RPD	QC Limits
Lead	21.6	33.1	84%	20%
Zinc	65	78.1	77%	20%

There were no flags applied to the samples since the sample spiked was taken from another TMDL site.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP.

All samples were prepared and analyzed within the hold time specified in the QAPP.

The laboratory blank was reviewed and found to be free of SEM above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All SEM results for the samples in this report were considered usable. The completeness for the SEM portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

AVS IN SEDIMENT

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for Acid Volatile Sulfide (AVS). The AVS analyses were performed using EPA method 376.3.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and MS/MSD samples. A sample from a different TMDL site was used for the MS/MSD for the batch QC for this group. The results for the MS/MSD will be discussed although not used to qualify the data for the sample in this group.

All LCS %Rs met acceptance criteria.

All MS and MSD %Rs met acceptance criteria.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the MS/MSD recoveries.

All MS/MSD RPDs were within laboratory specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP with the exceptions noted above.

All samples were prepared and analyzed within the hold time required by the QAPP.

The laboratory blank was reviewed and found to be free of AVS at the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All AVS results for the samples in this report were considered usable. The completeness for the AVS portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TOC

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for total organic carbon (TOC). The TOC analyses were performed using B&B Laboratories, Inc. Standard Operating Procedure 1005.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the standard reference material (SRM) samples.

TOC met acceptance criteria in both SRM samples analyzed.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

Two method blanks were analyzed in association with the samples. Both blanks were free of TOC at the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All TOC results for the samples in this report were considered usable. The completeness for the TOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

GRAIN SIZE

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on July 20, 2001, and was analyzed for grain size by GS-92-01-B&B Method. Grain size results are reported as a percent of sand, silt or clay based on the weight of the sample.

Accuracy

Accuracy could not be evaluated by this method.

Precision

Precision could not be evaluated by this method.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

There were no method blanks required by this method.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All results for grain size for the sample in this report were considered usable. The completeness for the grain size compound portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

DATA VERIFICATION REPORT

for sediment samples collected from Segment 2201,

ARROYO COLORADO TIDAL TMDL SITE

February 18, 2002

Data Verification by: Sandra de las Fuentes

The following data verification summary report covers environmental sediment samples collected from the Arroyo Colorado Tidal Segment 2201, Station 13782, on February 18, 2002.

A Chemist with Parsons has reviewed the data submitted by DHL Analytical, APPL, Inc. and TRAC Environmental Technology and Chemistry.

The samples in this event were analyzed for volatiles, semivolatiles, pesticides (including triazines, PCBs, organophosphorus compounds, herbicides and carbamates), total metals, anions, simultaneously extracted metals (SEM), acid volatile sulfide (AVS), total organic carbon (TOC) and grain size.

There were no field quality control samples collected at this site. No trip blanks were analyzed for volatiles and no field blanks or equipment blanks were collected in association with the sediment samples in this DVR. Therefore, the possibility of contamination during sampling or handling could not be evaluated for these samples.

All samples were collected by Parsons and were analyzed by the various laboratories following procedures outlined in the Assessment of the Presence and Causes of Ambient Toxicity Quality Assurance Project Plan (QAPP).

REVIEW CRITERIA

All data submitted by the various laboratories has been reviewed. Field and laboratory QC sample information was examined, including: laboratory blanks, laboratory control samples (LCS), laboratory duplicates, standard reference material (SRM) samples, matrix spikes and matrix spike duplicate (MS and MSD) samples, surrogate spikes and Chain-of-Custody (COC) forms. The findings presented in this report are based on the reviewed information and whether the requirements specified in the project QAPP were met.

VOLATILES

General

This sample group consisted of two samples, including one (1) environmental sediment sample and one (1) field duplicate sample. The samples were collected on February 18, 2002, and were analyzed for volatile organic compounds (VOCs). The VOC analyses were performed using USEPA SW846 Method 8260B.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.

The percent recoveries for the LCS were all within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the field duplicate analyte results. Sample 13782C DUP1 was collected and analyzed as the field duplicate for sample 13782C.

The field duplicate RPD was within acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was analyzed in association with the samples. The blank was free of target analytes above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All volatile results for the samples in this report were considered usable. The completeness for the VOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

SEMIVOLATILES

General

This sample group consisted of two (2) samples; one (1) environmental sediment sample and one (1) field duplicate sample. The samples were collected on February 18, 2002, and were analyzed for semivolatile organic compounds (SVOCs). The SVOC analyses were performed using USEPA SW846 Method 8270C.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and the surrogate spikes.

All LCS %Rs were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the field duplicate results. Sample 13782C DUP1 was collected and analyzed as the field duplicate for sample 13782C.

The field duplicate RPD was within acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was analyzed in association with the samples. The blank was free of target analytes above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All semivolatile results for the samples in this report were considered usable. The completeness for the SVOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TRIAZINES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on February 18, 2002, and was analyzed for triazine. The triazine compounds, atrazine, cyanazine, metolachlor and simazine, were analyzed using USEPA SW846 Method 8141A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for LCS sample and surrogate spikes.

The LCS percent recoveries were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the triazine analyses. The blank was free of any triazines above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All triazine results for the sample in this report were considered usable. The completeness for the triazine portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

PESTICIDES / PCBS

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on February 18, 2002, and was analyzed for pesticides and PCBs. The pesticide/PCB analyses were performed using USEPA SW846 Method 8081A/8082.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.

The LCS percent recoveries were within acceptance criteria, except for the following:

Analyte	%R LCS	QC Limits
DDD	138	51-124
Endrin	147	43-124
Heptachlor	129	60-118
PCB1016	119	64-110

Since the sample result was non-detect for DDD, Endrin, Heptachlor and PCB1016 and since the compounds listed were above tolerance in the LCS, no corrective action was necessary.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the pesticide/PCB analyses. The blank was free of any pesticides or PCBs of concern above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All pesticide/PCB results for the samples in this report were considered usable. The completeness for the pesticide/PCB portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

ORGANOPHOSPHORUS COMPOUNDS

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on February 18, 2002, and was analyzed for organophosphorus compounds. The organophosphorus compounds, Chloropyrifos, Demeton, Diazinon, Guthion, Malathion and Parathion were analyzed using USEPA SW846 Method 8141A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.

The LCS percent recoveries were within acceptance criteria, except for the following:

Analyte	%R LCS	QC Limits
Demeton	1.69	22-144
Guthion	230	42-166

No corrective action was necessary for Guthion in the LCS since it was above tolerance and the sample result was non-detect. Demeton recovered below criteria in the LCS therefore the non-detect sample result was flagged "UJ".

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the organophosphorus compound analyses. The blank was free of any organophosphorus compounds above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All organophosphorus compound results for the sample in this report were considered usable. The completeness for the organophosphorus compound portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

HERBICIDES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on February 18, 2002 and was analyzed for herbicides. Herbicides, 2,4,5-T, 2,4,5-TP (Silvex) and 2,4-D, were analyzed using USEPA SW846 Method 8151A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.

The LCS percent recoveries were within acceptance criteria.

The surrogate spike recovery met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

The method blank was run in association with the herbicide analyses. The blank was free of any herbicides above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All herbicide results for the samples in this report were considered usable. The completeness for the herbicide portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

CARBAMATES

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on February 18, 2002 and was analyzed for carbamates. The carbamate compounds, carbaryl and diuron were analyzed using USEPA SW846 Method 8321A.

Accuracy

Accuracy was evaluated using the percent recovery (%R) results for the LCS sample and surrogate spikes.

The LCS percent recoveries were within acceptance criteria.

All surrogate spike recoveries met laboratory specified tolerance in the samples, QC and method blanks.

Precision

There was no precision data available for evaluation.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

One method blank was run in association with the carbamate analyses. The blank was free of any carbamates of concern above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All carbamate results for the samples in this report were considered usable. The completeness for the carbamates portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TOTAL METALS AND IONS

General

This sample group consisted of two (2) samples; including one (1) environmental sediment sample and one (1) field duplicate sample. The samples were collected on February 18, 2002 and were analyzed for total metals (aluminum, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, silver, sodium and zinc). The mercury analyses were performed

using USEPA SW846 Method 7471A. All other metals were determined using USEPA SW846 Method 6020B.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS.

All LCS %Rs met acceptance criteria.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the results of the field duplicate samples. Sample 13782C DUP1 was collected and analyzed as the field duplicate of sample 13782C.

The field duplicate RPD was within acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP with the exceptions noted above.

All samples were prepared and analyzed within the hold time required by the method.

All laboratory blanks were free of target analytes above the MAL.

No calibration, analytical spike or dilution test information was provided for the analyses.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metals results for the samples in this report were considered usable. The completeness for the metals portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

ANIONS (CHLORIDE AND SULFATE)

General

This sample group consisted of two (2) samples; one (1) environmental sediment sample and one (1) field duplicate sample. The samples were collected on February 18, 2002, and were analyzed for chloride and sulfate using USEPA SW846 Method 9056.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and LCSD samples.

All LCS and LSCD %Rs met acceptance criteria.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the LCS/LCSD recoveries and the field duplicate sample results. Sample 13782C DUP1 was collected and analyzed as the field duplicate of sample 13782C. Sample 13782C was randomly selected by the laboratory as a laboratory duplicate.

LCS/LCSD RPDs were within laboratory specified acceptance criteria for chloride and sulfate.

The field duplicate RPD was within acceptance criteria.

The laboratory duplicate RPD was within acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP.

All samples were prepared and analyzed within the hold time required by the method.

All laboratory blanks were free of target analytes above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metals results for the samples in this report were considered usable. The completeness for the metals portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

SEM IN SEDIMENT

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on February 18, 2002, and was analyzed for Simultaneously Extracted Metals (SEM), including cadmium, copper, lead, mercury, nickel and zinc.

The metals analyses were performed using a modified EPA 821 draft.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and MS samples. Sample 13782C was used as the MS sample for this data group.

All LCS %Rs met QAPP acceptance criteria.

No accuracy criteria for the MS samples were listed in the QAPP for the SEM analyses. The tolerances listed for total metals analyses were used to evaluate the MS samples.

All MS %Rs for SEM metals met the QAPP total metals acceptance criteria except for the following:

Analyte	MS %R	QC Criteria
Zinc	304%	80-120%

The laboratory explained the spiked recovery indicated possible matrix interference and/or sample non-homogeneity. The post-spike recovery for Zinc was 93.2%; therefore no flags were applied.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the sample duplicate concentrations. Sample 13782C was analyzed as the laboratory duplicate for this data group.

All laboratory duplicate RPDs were within QAPP specified acceptance criteria with the exception of the following:

Analyte	Sample Conc. (mg/kg)	Dup Conc. (mg/kg)	RPD	QC Limits
Mercury	0.0033	0.014	123.7%	40%

There were no flags applied since the sample and duplicate concentrations were so low.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP.

All samples were prepared and analyzed within the hold time specified in the QAPP.

The laboratory blank was reviewed and found to be free of SEM above the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All SEM results for the samples in this report were considered usable. The completeness for the SEM portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

AVS IN SEDIMENT

General

This sample group consisted of one (1) environmental sediment sample. The sample was collected on February 18, 2002, and was analyzed for Acid Volatile Sulfide (AVS). The AVS analyses were performed using EPA method 376.3.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and MS samples. Sample 13782C was used for the MS sample in this data group.

All LCS %Rs met acceptance criteria.

The MS %Rs met QAPP acceptance criteria.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the sample duplicate recoveries. Sample 13782C was analyzed in duplicate as the laboratory duplicate sample for this data group.

The laboratory duplicate RPD was within QAPP specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the procedures outlined in the QAPP with the exceptions noted above.

All samples were prepared and analyzed within the hold time required by the QAPP.

The laboratory blank was reviewed and found to be free of AVS at the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All AVS results for the samples in this report were considered usable. The completeness for the AVS portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

TOC

General

This sample group consisted of two (2) samples; including one (1) environmental sediment sample and one (1) field duplicate sample. The samples were collected on February 18, 2002, and were analyzed for total organic carbon (TOC). The TOC analyses were performed using EPA 415.1.

Accuracy

Accuracy was evaluated using the percent recovery (%R) for the LCS and MS/MSD samples.

All LCS %Rs met QAPP acceptance criteria.

The MS %Rs met QAPP acceptance criteria.

Precision

Precision was evaluated using the Relative Percent Difference (RPD) obtained from the sample duplicate recoveries. Sample 13782C was analyzed in duplicate as the laboratory duplicate sample for this data group.

The laboratory duplicate RPD was within QAPP specified acceptance criteria.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for contamination of samples during analysis.

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

Two method blanks were analyzed in association with the samples. Both blanks were free of TOC at the MAL.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All TOC results for the samples in this report were considered usable. The completeness for the TOC portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

GRAIN SIZE

General

This sample group consisted of two (2) samples; including one (1) environmental sediment sample and one (1) field duplicate sample. The samples were collected on February 18, 2002, and were analyzed for grain size by EPA 3.4, 3.5 (600/2-78-054). Grain size results are reported as a percent of sand, silt or clay based on the weight of the sample.

Accuracy

Accuracy could not be evaluated by this method.

Precision

Precision could not be evaluated by this method.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing actual analytical procedures to those described in the QAPP;
- Evaluating holding times; and

All samples were prepared and analyzed following the QAPP and within the hold time required by the method.

There were no method blanks required by this method.

Completeness

Completeness was evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All results for grain size for the sample in this report were considered usable. The completeness for the grain size compound portion of this data set is 100%, which meets the minimum QAPP acceptance criteria of 90%.

APPENDIX F

TECHNICAL MEMO REFERRING TO STATISTICAL ANALYSIS OF NON-PARAMETRIC AMBIENT SEDIMENT DATA

Patrick Bayou Evaluation of Sediment Mortality Data to Determine Toxicity

Technical Memorandum 3
July 2001

SUMMARY

The purpose of this technical memorandum is to discuss the statistical evaluation of the mortality data collected during the sediment toxicity testing program. This memorandum is written because the measured data were discovered not to meet the assumptions established for the statistical testing that is typically encountered during the evaluation of toxicity data. Specifically, the data were not normally distributed and could not be transformed into a data set that was normally distributed.

BACKGROUND

The sediment toxicity results that the laboratory provided were generated by hypothesis testing with parametric statistical methods (ANOVA, t-test with Bonferroni's adjustment). Upon further review of the raw data, it was established that the data were not normally distributed, and could not be transformed to approximate a normal distribution. Therefore, these parametric methods were not appropriate for hypothesis testing of the sediment mortality data collected in August 2000 and April 2001.

EVALUATION

The EPA guidance document "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminant with Marine Organisms" outlines an approach for the selection of statistical methods of hypothesis testing. Following the decision tree for analysis of data subject to hypothesis testing (Figure 12.7 in EPA 600/R-94/025), the appropriate procedure for non-normal data with greater than three replicates, and unequal replication, is the Wilcoxon Rank-Sum Test with Bonferroni Adjustment. Wilcoxon Rank-Sum test is a nonparametric test used when the number of replicates are not equal between two treatments. A Bonferroni adjustment of the pairwise error rate for comparison of each treatment versus the control is used to bound the overall error rate when multiple comparisons are made. We re-analyzed the raw sediment mortality data collected in the PBS&J environmental toxicology laboratory in August 2000 and April 2001 using this procedure The results (see attached spreadsheet) are slightly to somewhat different, depending on what minimum level of significant mortality is applied.

In some cases, even though common sense would indicate otherwise, differences in mortality of less than 10% between samples and the control at individual stations were deemed statistically significant at an alpha=0.05 by the non-parametric method. The method does not specify a minimum significant difference (MSD) in mortality, but states:

> "Because no consensus currently exists on what constitutes a biologically acceptable MSD, the appropriate statistical minimum significant difference should be a data quality objective (DQO) established by the individual user (e.g., program considerations) based on their data requirements, the logistics and economics of test design, and the ultimate use of the sediment toxicity test results."

Therefore, the selection of the minimum level of significant mortality is a program-specific consideration that is not specified within the existing methodology. Various programs were reviewed. For example, some other EPA water toxicity methods do not consider a sample to be toxic unless mortality exceeds that in the control by 10%. Also, in whole effluent toxicity (WET) testing of wastewater discharges, for samples to be considered toxic requires that survival is less than the minimum acceptable control survival (i.e. 80 percent in the chronic test) In general, protocols applicable to sediment toxicity are not as well established as those for water methods. However, a 1992 EPA Region 6/ Galveston Corps of Engineers Regional Implementation Agreement for the Ocean Disposal of Dredged Material Off the Texas Coast states:

> "Dredged material does not meet the LPC for benthic toxicity when bioassay organism mortality (1) is statistically greater than in the reference sediment, and (2) exceeds mortality in the reference sediment by at least 10% or exceeds the reference mortality by 20% when amphipods are used."

These approaches document ample justification for the selection of a programmatic minimum significant difference in survival of the test organism relative to the control. We believe that a minimum significant difference in survival of 20% is appropriate with both *Neanthes* and *Leptocheirus*. Based on the data requirements, the logistics and economics of sediment toxicity test design, and the ultimate use of the sediment toxicity test results, we recommend a conservative approach (e.g. the power of the test to be high). Therefore, we believe that the appropriate criteria for determining these sediments to be toxic to *Neanthes* and *Leptocheirus* is the following:

- a statistically significant reduction in survival, at alpha equal to 0.05, and
- mortality in the sample exceeding that of the control by 20 percent.

APPENDIX G
STREAM HABITAT FORMS

Part I - Stream Physical Characteristics Worksheet

Observers:_____ Date: 04-23-01 Time:_____ Weather conditions: Partly cloudy, hot

Stream: Arroyo Colorado Tidal Location of site: Mkr 16, Site 13782 Length of stream reach: 1 mile

Stream Segment No.: 2201 Observed Stream Uses: Recreation/Fishing/Boating Aesthetics (circle one): (1) wilderness (2) natural **(3) common** (4) offensive

Stream Type (Circle One): **perennial** or intermittent w/ perennial pools Stream Bends: No. Well Defined_____; No. Moderately Defined 3 ; No. Poorly Defined

Channel Obstructions/Modifications: dredged to 5 m No. of Riffles: 0 Channel Flow Status (circle one): high **moderate** low no flow

Riparian Vegetation (%):

Left Bank: Trees 20 Shrubs 25 Grasses, Forbs 50 Cult. Fields_____ Other 5 (Bare bank)
Right Bank: Trees 15 Shrubs 10 Grasses, Forbs 55 Cult. Fields_____ Other 20 (Homes, docks)

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect Thalweg Depth:	Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)
	100	90	30		30	10	0

Mkr. 16 Site 13782	Habitat Type (Circle One) Riffle Run **Glide** Pool	Dominant Substrate Type Clay Sand	Dominant Types Riparian Vegetation: Left Bank: Mesquite/Coastal Bermuda Right Bank: Coastal Bermuda/Mesquite	% Gravel or Larger 0
	Algae or Macrophytes (Circle One) **Abundant** Common Rare Absent	Width of Natural Buffer Vegetation (m) LB: >100m RB: 0	Instream Cover Types: None	% Instream Cover 0

Brown Algae Bloom

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect Thalweg Depth:	Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)
	100	80	30		90	30	10

Mkr. 22 Site 13071	Habitat Type (Circle One) Riffle Run **Glide** Pool	Dominant Substrate Type Clay Sand Silt	Dominant Types Riparian Vegetation: Left Bank: Coastal Bermuda/Mesquite Right Bank: Coastal Bermuda/Mesquite	% Gravel or Larger 0
	Algae or Macrophytes (Circle One) Abundant Common Rare Absent	Width of Natural Buffer Vegetation (m) LB: >100m RB: 50m	Instream Cover Types: None	% Instream Cover 0

Brown Algae Bloom

Part I - Stream Physical Characteristics Worksheet

Observers:_____ Date: 04-24-01 Time: 1020 Weather conditions: Overcast

Stream: Arroyo Colorado Tidal Location of site: FM 106, Site 13072 Length of stream reach: 1 mile

Stream Segment No.: 2301 Observed Stream Uses: Boating/Fishing/Barge traffic Aesthetics (circle one): (1) wilderness (2) natural **(3) common** (4) offensive

Stream Type (Circle One): **perennial** or intermittent w/ perennial pools Stream Bends: No. Well Defined_____; No. Moderately Defined 2 ; No. Poorly Defined

Channel Obstructions/Modifications: dredged to 5 m ; overnight rain, muddy water No. of Riffles:_____ Channel Flow Status (circle one): **high** moderate low no flow

Riparian Vegetation (%):

Left Bank: Trees 15 Shrubs 40 Grasses, Forbs 30 Cult. Fields_____ Other 15 (Bare bank)
Right Bank: Trees 70 Shrubs 10 Grasses, Forbs 10 Cult. Fields_____ Other 10 (Bare bank)

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect Thalweg Depth:	Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)
	80	45	10		45	10	80

	Habitat Type (Circle One) Riffle Run Glide Pool	Dominant Substrate Type	Dominant Types Riparian Vegetation:	% Gravel or Larger
		Sandy Clay Silt	Left Bank: Mesquite/Cane/Cacti/Coastal Bermuda Right Bank: Mesquite/Cane/Coastal Bermuda	0
	Algae or Macrophytes (Circle One) Abundant **Common** Rare Absent	Width of Natural Buffer Vegetation (m) LB: >100m RB: 15m	Instream Cover Types: Cane	% Instream Cover 2

Location of Transect	Stream Width (m)	Left Bank Slope (°)	Left Bank Erosion Potential (%)	Stream Depths (m) at Points Across Transect Thalweg Depth:	Right Bank Slope (°)	Right Bank Erosion Potential (%)	Tree Canopy (%)

	Habitat Type (Circle One) **Riffle Run Glide Pool**	Dominant Substrate Type	Dominant Types Riparian Vegetation:	% Gravel or Larger
			Left Bank: Right Bank:	
	Algae or Macrophytes (Circle One) **Abundant Common Rare Absent**	Width of Natural Buffer Vegetation (m) LB: RB:	Instream Cover Types:	% Instream Cover

Stream Habitat Summary

Sample Location Site Number	Units	Arroyo Colorado Tidal 13782	Arroyo Colorado Tidal 13071	Arroyo Colorado Tidal 13072
Date		04/23/01	04/23/01	04//24/01
Aesthetics		Common	Common	Common
Stream Bends				
Obstructions/Modifications		Dredged to 5m	Dredged to 5m	Dredged to 5m, muddy water
Riffles		0	0	
Flow Status		Moderate	Moderate	high
Riparian Vegetation:				
Trees	%	18	18	43
Shrubs	%	18	18	25
Grass, Forbs	%	28	28	20
Cultivated Fields	%			
Stream Width	(ft)	100	100	80
Maximum Depth	(m)			
In-Stream Vegetation Type		None	None	Cane
In-Stream Cover	%	0	0	2
Dominant Substrate Type		Clay Sand	Clay Sand Silt	Sandy Clay Silt
Bank Erosion	%	20	30	10
Average Bank Slope	degrees	30-90	30-80	45
Tree Canopy	%	0	0	80